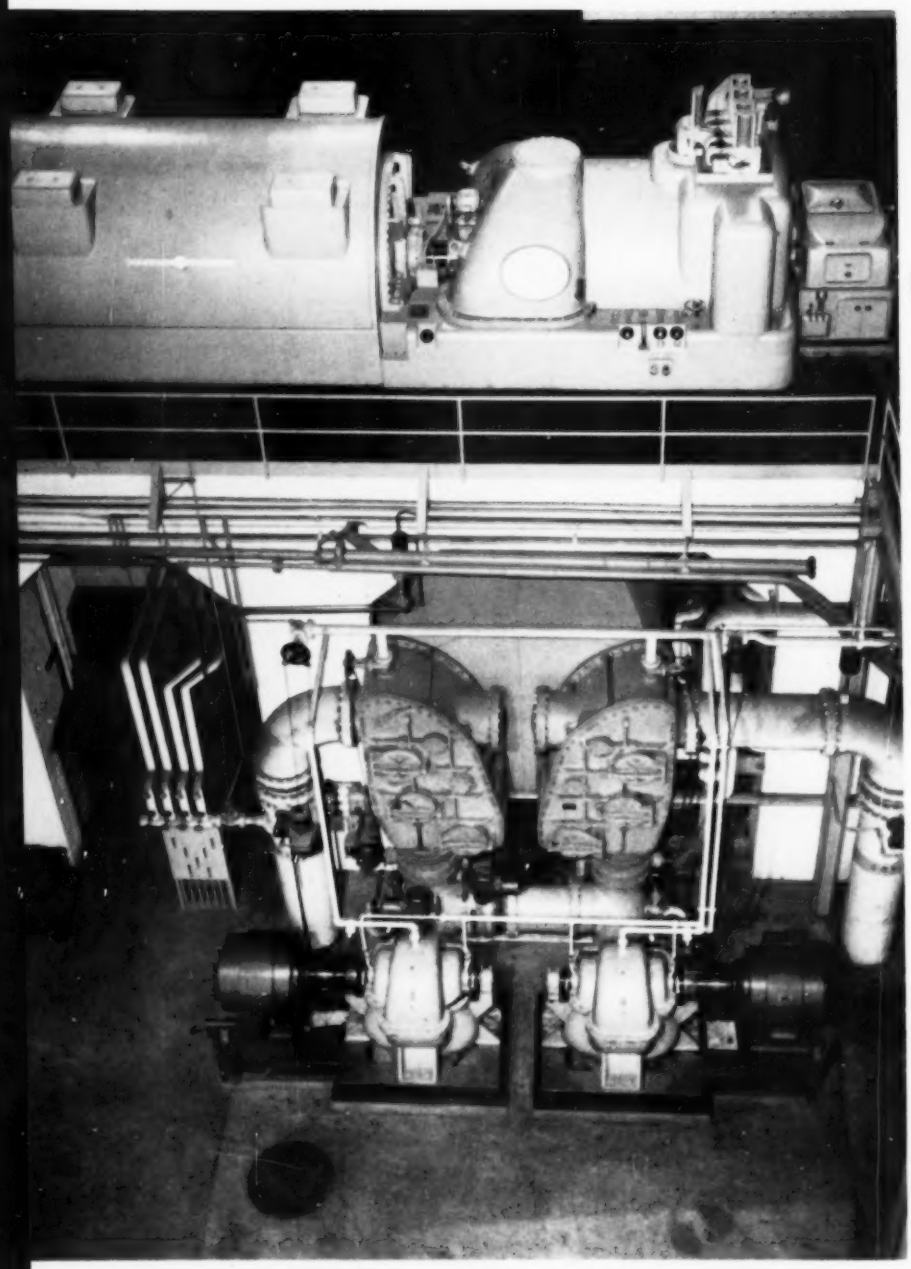
Industry and Power



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or engineers and engineering executives responsible for

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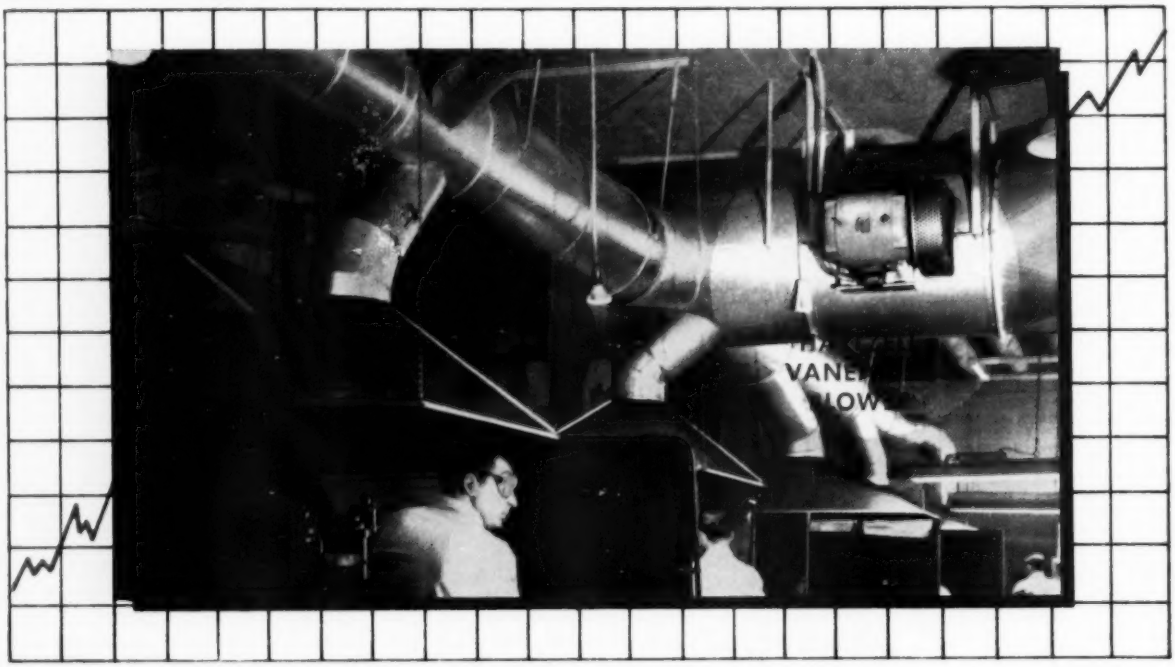
Hartzell Air-Moving Equipment
Can Brighten Your Production Picture, Too



Built-in Power To Move Air Against Pressure

If you need a powerful blast of air against pressures as high as 7½" water gauge, you need to know about Hartzell vaneaxial blowers. Belt-drive models from 12" to 54", direct-drive from 18" to 42".

With the special Hartzell High Temperature Vaneaxial Blower you can move air at elevated temperatures, or air containing acids, alkalies or grit, without fear of premature failure of belts and bearings. Write for details.

Production in a large Jersey City plant was hampered by accumulations of heat, smoke and fumes over 29 die-casting machines. Three canopy-exhaust systems, powered by Hartzell vaneaxial blowers, now remove the irritating elements before they can cause trouble. As soon as working conditions were improved, production showed a substantial increase.

Hartzell specialization in *industrial* air-moving problems paid off for this company. It can help you, too.

Your nearby Hartzell field representative puts the engineering "know-how" of the whole organization right in your back yard. If inadequate ventilation is clouding your production picture, give him a call today. Hartzell's complete line includes the fan or blower which will solve your problem.

Write today for your copies of Bulletins describing Hartzell propeller fans and vaneaxial blowers. They're rich with valuable engineering data.

HARTZELL *propeller fan co.*

Div. of Castle Hills Corp.

Dept. B

PIQUA, OHIO

PROPELLER-TYPE FANS • BLOWERS
ROOF VENTILATORS • UNIT HEATERS

ENGINEERING OFFICES IN PRINCIPAL CITIES

Name _____
Company _____
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If student, check here for special information ☐

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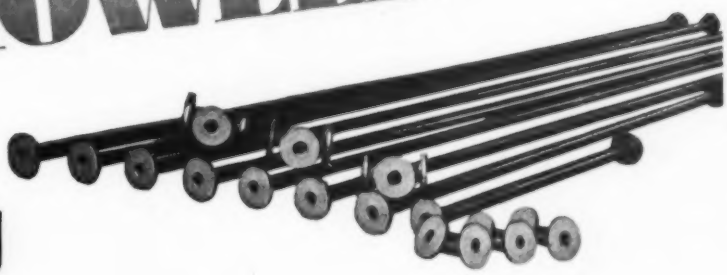
You Can Save More with

PLIOWELD



Lined Piping

WHEREVER you handle corrosives, abrasive materials and other enemies of metal piping, it will pay you to investigate the savings you can make with PLIOWELD—Goodyear's lining material that bonds *permanently* to metal surfaces.

7 REASONS WHY
THE G.T.M. SPECIFIES PLIOWELD

1 Effectively seals in corrosives that cannot be handled in metal

2 Bonds permanently to metal surfaces—an exclusive Goodyear process

3 Does not split or loosen with vibration or severe external impacts

4 Does not crack or buckle under alternate wetting and drying or under temperature changes

5 Surface will not disintegrate or slough off—*cannot ever contaminate in-process materials*

6 Protects product from discoloration, iron "pickup" and other contaminants

7 Each installation specially formulated to provide maximum protection against chemical handled

The G.T.M.—Goodyear Technical Man—will gladly discuss your problem—and recommend a PLIOWELD lining matched to your needs that will give you these benefits:

LOWER OVER-ALL COST because the useful life of PLIOWELD lined pipe so far exceeds unlined pipe that its slightly higher initial cost is more than made up by your savings in replacement outlays.

LOWER MAINTENANCE COST. Because PLIOWELD is absolutely impervious to corrosion, daily inspections and frequent maintenance shutdowns are eliminated. *The savings this means should cover the cost of* PLIOWELD *lining in a short time.*

IMPROVED PRODUCTION where PLIOWELD lined pipes handle production items. Your product is protected against taint and discoloration because the lining won't slough off or contaminate liquids.

Ask the G.T.M. about PLIOWELD lined pipes, fittings and equipment—everything from laboratory equipment to rail tank cars—or write Goodyear, Mechanical Goods Division, Akron 16, Ohio.

Plioweld—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

GOODYEAR

THE GREATEST NAME IN RUBBER

Circle 501 on Reply Card for more data

Now!

B&W SMOOTHSET

Available in Dry Form

Here's the mortar refractories masons asked for—and it's as easy to use with insulating firebrick as the popular wet B&W Smoothset because it has the same high water retention.

This property is important because the highly porous structure of insulating firebrick draws the moisture rapidly from the mortar, thus allowing too short a time for proper placing and setting of the brick before most mortars become unworkable.

Besides high water retention, the new dry B&W Smoothset can be stored indefinitely in a dry place without hardening—a big advantage on large jobs when refractories are installed over a long period of time.

In addition to helping you select the most economical refractories, your local B&W Refractories Engineer will be glad to help you select the best mortar for your installation. Next time you build or reline your furnace, get the benefit of his long experience.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.
REFRACTORIES DIVISION
GENERAL OFFICES: 161 EAST 42nd ST., NEW YORK 17, N.Y.
WORKS: AUGUSTA, GA.

R459

B&W REFRACTORIES PRODUCTS—B&W Allmul Firebrick • B&W 80 Firebrick • B&W Junior Firebrick • B&W Insulating Firebrick B&W Refractory Castables, Plastics and Mortars • **OTHER B&W PRODUCTS**—Stationary & Marine Boilers and Component Equipment... Chemical Recovery Units . . . Seamless & Welded Tubes . . . Pulverizers . . . Fuel Burning Equipment . . . Pressure Vessels . . . Alloy Castings

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Industry and Power

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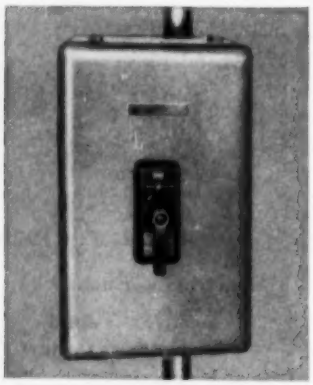
Need Protection on your circuits?



up to 600 volts a-c

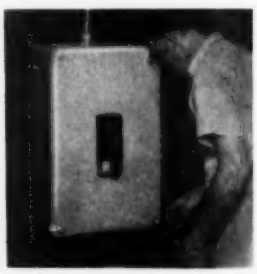
Install G-E Air Circuit Breakers

Specify General Electric Type AK air circuit breakers instead of other protective devices for service entrance—feeders—lighting—and for full benefits of overload protection and switching.

G-E wall mounted breakers interrupt and disconnect electrical circuits in plants and buildings that today require high interrupting capacity devices—they can be operated with maximum safety even under fault conditions—they are smaller and more economical, over a period of time, than other equivalent devices. The breaker is removed from the case for easy installation.

Lower rated Type AK wall mounted breakers are available locally, with larger sizes on short delivery.

Call your local G-E Sales Office or Distributor. General Electric Company, Schenectady 5, N. Y. 873-6



You can put your confidence in—

GENERAL ELECTRIC

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acorns

. . . recently announced . . . worth watching

Chrome Carbides Unlimited

• In spray nozzles, steam valves, and orifices for processing foods, soaps, and drugs, chrome carbide is already outlasting other metals. Now that an unlimited number of cemented chrome carbide grades are available for engineering experimentation, the Carboloy Dept. of G. E. expects to find greatly expanded uses for the versatile metal.

Plywood From Waste Wood

• After more than three years of experimental work, a new type of plywood made basically of wood waste is now ready for large-scale pilot plant manufacture. The new board will cost very much less to manufacture than conventional plywood—and for a given log, the process will yield from three to five times more footage.

Using Bunker "C"

• A locomotive gas-turbine fuel system capable of using Bunker "C" fuel—low in cost but hard to pump—is being developed by engineers at Thompson Products, Inc., Cleveland, together with a locomotive manufacturer. Thompson is working on fuel pump, fuel distributor, control, nozzles for the system.

Guaranteed for Life

• The auto battery "guaranteed for life" is now on the market. It reflects current heavy research emphasis on durability as a prime sales point for batteries. Competition has driven prices down to where the major cost is that of raw materials, and sales point to quality, which generally shows up in longer life. The nickel-cadmium cell which has long been used in Europe for automotive starting, power stations, and communications, has recently been introduced here, although not for automobile use. Several American companies are now manufacturing nickel-cadmium batteries with a special sintered plate construction to reduce the size and weight. This type of battery is finding uses in emergency lighting, switchgear operations, and industrial equipment. For such service, life expectancy might be 15 to 20 years, compared with a common expectancy of 5 to 10 years (or in some cases, up to 20 years) for a lead cell battery.

Acceptable Substitute

• An acceptable substitute for natural gas may be available late in 1954 or early in 1955. This claim is based on research conducted at the Institute of Gas Technology, Illinois Institute of Technology. By a new process of pressure hydrogasification, a completely interchangeable natural gas substitute was produced from natural gasoline with complete conversion of the gasoline.

Atomic Heating

• Large quantities of waste heat developed in atomic reactors at the Hanford plutonium-producing plant at Richland, Washington, will shortly be used for the first time in this country for heating buildings. This practical industrial utilization of excess heat will be achieved by indirectly using water carrying away reactor heat. Heat is transferred to warm the air drawn into certain Hanford plant structures now under construction at the site.

Remote Hydro-Power

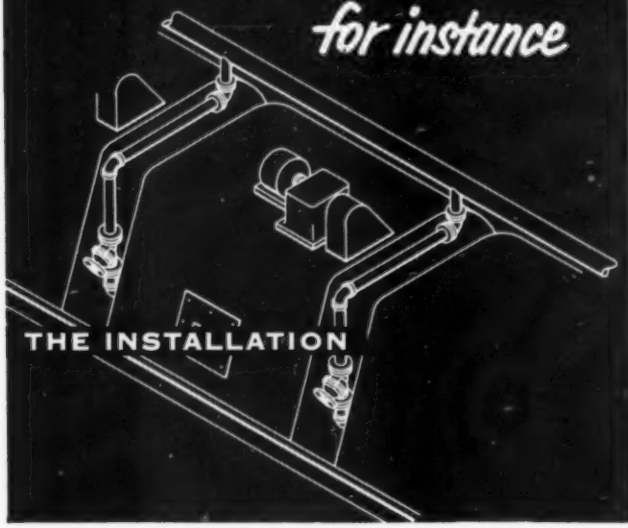
• Improvements in control components and over-all simplification of switchgear in the last few years have made possible more effective use of water power in remote areas. Automatic control makes many marginal sites well worth considering. The expense of maintaining constant supervision by specially trained technicians is eliminated. Only occasional checks on the condition of the equipment are necessary. Emergencies are automatically taken care of by reliable, fast acting control.

Pocket-Size X-Ray

• X-rays now are used for inspecting vital parts, but the bulky equipment needed to produce them limits their usefulness. Research efforts sponsored by the Armour Research Foundation have been aimed at development of a "pocket-size" radiation source. Now, the new X-ray source can be made in almost any size, from tiny pellets to larger blocks or sheets. They are entirely self contained. There is no bulky electronic equipment and no wiring connections to be made.

These Valves Last Longer-at Lower Cost

...on Toughest Water Services for instance



VALVE SERVICE RATINGS

SUITABILITY:	Ideal for the job
FEATURES:	Packless – No stuffing box
MAINTENANCE COST:	None
SERVICE LIFE:	Show no wear after more than 3 years
OPERATING RESULTS:	No leakage – easy operation
AVAILABILITY:	Regular Crane item – No. 1611

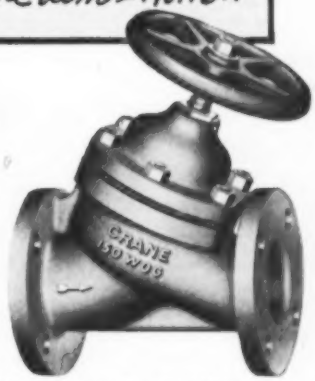
In a Southern public utility's power plant, with Crane Diaphragm Valves on water spray lines for cleaning traveling screens on condenser water intake.

THE CASE HISTORY

Both raw Mississippi River water and deep well water are used for the cleaning spray to the screens. The valves are exposed to a combination of river water sand erosion, and well water sodium chloride corrosion. These conditions caused stem packing leaks, difficult valve operation, and also corroded the steel bonnet bolts. Maintenance costs were excessive.

The trouble was stopped by installing Crane No. 1611 Packless Diaphragm Valves featuring separate disc and diaphragm design. After more than 3 years' operation, they show no effects of service. They operate smoothly and seat tightly. Crane Diaphragm design eliminates leaks entirely, and no maintenance has been needed. Based on this performance record, additional Crane Diaphragm Valves have been installed.

THE VALVE



In Crane Packless Diaphragm Valves, the diaphragm seals the working parts from all erosive or corrosive fluids. Need for a stuffing box is eliminated. Choose these valves from a wide variety of body and trim materials, lined or unlined, for better, lower-cost handling of countless corrosive, erosive, or ordinary services. See your Crane Catalog or your Crane Representative.

THE BETTER QUALITY...BIGGER VALUE LINE...IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

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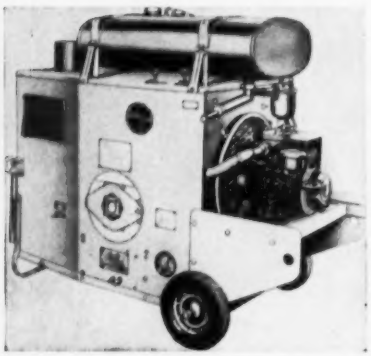
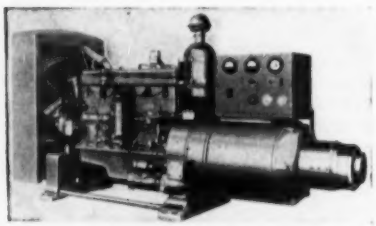
new equipment

. . . new developments



Portable air heater features fuel metering valve

M10 The redesigned Standard Model Herman Nelson portable air heater announced by American Air Filter Co., Inc. features a fuel metering valve which can reduce the capacity of the unit from its maximum of 385,000 Btu to a low of 100,000 Btu per hr. The valve is said to permit considerable saving in fuel consumption at the lower, frequently desired capacities. The unit is powered with a Briggs and Stratton Model 6 engine which has permitted modification in engine mounting resulting in a much simpler, cleaner arrangement of components at the air intake end of the heater.



Unit designed for heavy-duty or standby power

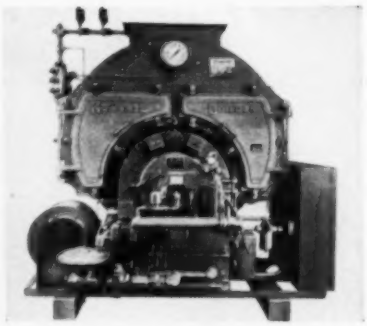
M11 Expanding their line of gasoline engine driven electric generating sets, D. W. Onan & Sons, Inc., announces a 50 kw, 62.5 kva electric plant, Model 50KA. This unit is designed for any type of job requiring heavy duty primary or emergency standby power and is said to deliver a full rated 50,000 w at 80 percent power factor with ample overload capacity. The engine delivers 104 hp at 1800 rpm and has a 450 cu in. piston displacement. It is equipped with replaceable cylinder liners, roto exhaust valves, oil bath air-cleaner, and a remote, 12-v starting system. Bulletin is available.

Alloy metallizers are designed for close control

M12 Two low temperature alloy metallizers, designed for close temperature and spray texture control have been made available by The Forrester Co. The sprayers are electrically heated, self-contained units with high quality ni-chrome heating elements and extremely sensitive temperature controls. Air requirements are 3½ cu ft per min at 35 to 75 lb pressure. Both units can be used for intermittent spraying and can handle alloys in billet, wire, rod, or powder form. Model C-5, 4 cu in. crucible capacity has a range of 0 to 400 F, model HL-7, 12 cu in. capacity has a range of 0 to 600 F.

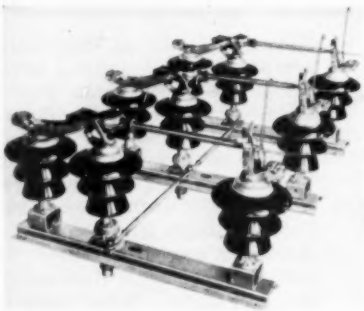
Conduit connectors protect wiring

M13 Liquid-Tight Connectors, manufactured by The Thomas & Betts Co., Inc., for flexible metal conduit are said to protect machine tool wiring against moisture, oil, and corrosive fluids. A pliable, plastic gripping ring provides the seal on plastic conduit sheath and protects the sheath against damage. The connector features positive ground for metal spiral inside conduit with the grounding member integral with body; and fits all thicknesses and convolutions in standard liquid-tight flexible metal conduit. A bulletin is available.



Companies combine talents to create boiler-burner unit

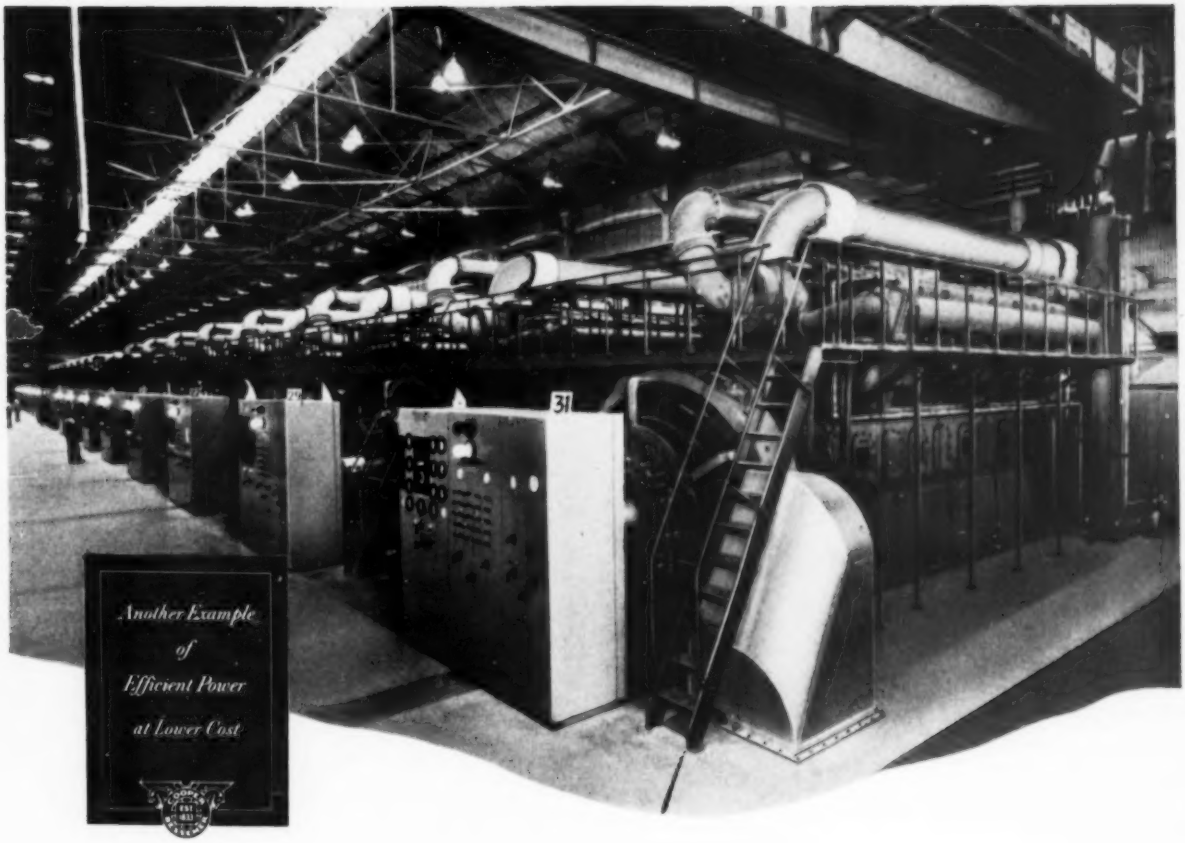
M14 Kewanee-Ross Corporation and the Ray Oil Burner Company jointly announce the new Kewanee-Ray Boiler-Burner Unit for high and low pressure steam and for hot water heating. The unit is being manufactured for high pressure steam to produce 39 to 456 certified output hp at 125 and 150 lb wp . . . and for low pressure 15 lb steam or 30 lb water in sizes to produce 1,313,000 to 15,300,000 Btu hourly. It is designed for forced draft operation with a multistage secondary air control on the burner. A bulletin is available.



Disconnect switches are for pole or structure mounting

M15 A complete line of outdoor, group-operated disconnect switches rated 7.5 through 69 kv, 400 and 600 amp, is being manufactured by the Line Material Company. These switches are designed for either pole or structure mounting in a horizontal,

NOTE—Each new product item has a key number for your convenience in asking for additional, detailed information. Circle this number on Reply Card, pages 34-35 & 94-95.



At Reynolds Metals' San Patricio plant...

greatest power... lowest cost with COOPER-BESSEMER LSV'S

● In their enormous new San Patricio aluminum reduction plant near Corpus Christi, the Reynolds Metals Company took advantage of the latest, most money-saving developments in engine power.

The above photo shows only half of the 33 Cooper-Bessemer 3,700 hp engines, all under one roof, powering pot line No. 1. It's easily the largest supercharged gas engine generating plant in the world.

What's more, because of their unmatched efficiency, these supercharged engines consume only 10 cubic feet of gas per kilowatt hour — a key factor in continuous power generation at lower cost than any other facility in the country. To give you a rough idea, these Cooper-Bessemers at Reynolds Metals save enough gas *daily* to serve a city of 25,000 population.

At the new Reynolds Metals' plant, power for over-all plant operation is likewise produced by Cooper-Bessemers — 9 identical LSV's housed in a separate building. Thus, there are 42 Cooper-Bessemer engines in all, totaling 155,400 horsepower — modern power at its efficient, money-saving best!

The Cooper-Bessemer Corporation

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas, Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. New Orleans, La.

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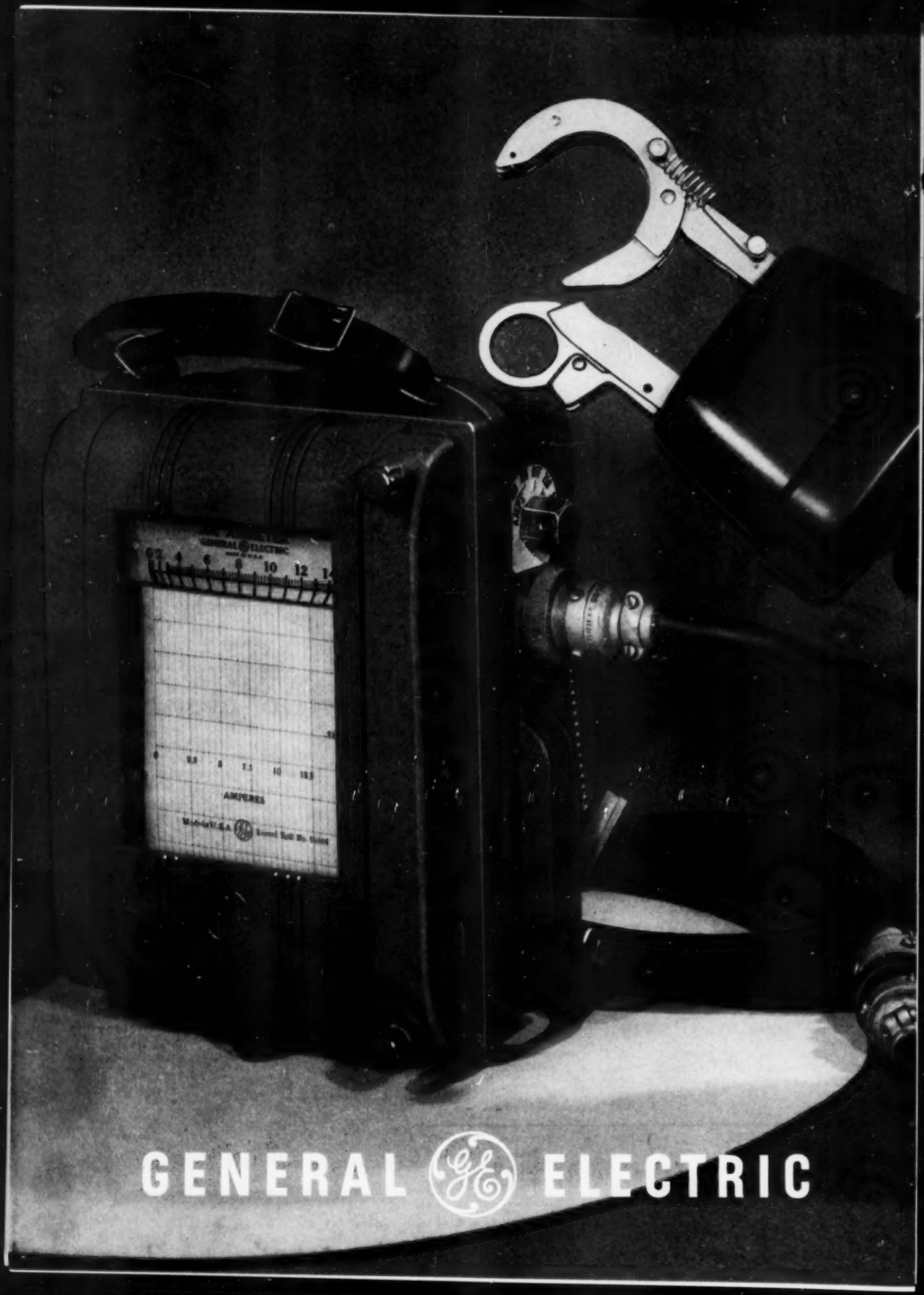

GENERAL ELECTRIC
AMPERES

COMPLETELY NEW—

G-E Hook-on Recorder

Here is a brand new solution to one of your old electrical-testing problems. General Electric's new CF-7 portable hook-on recorder (volt-ammeter) gives you the first convenient means of recording current without having to cut conductors or interrupt service.

By simply attaching leads, you can get voltage records over a wide range. The CF-7's butyl-molded transformer is insulated for 8700 volts.

FAST HOOK-ON INSTALLATION

You can install the CF-7 in little more time than it takes to use any hook-on instrument. Simply mount the recorder, select a range, attach leads, and hook on. Simplicity makes the CF-7 ideal for on-the-spot checking of loads on motors, circuits, and transformers.

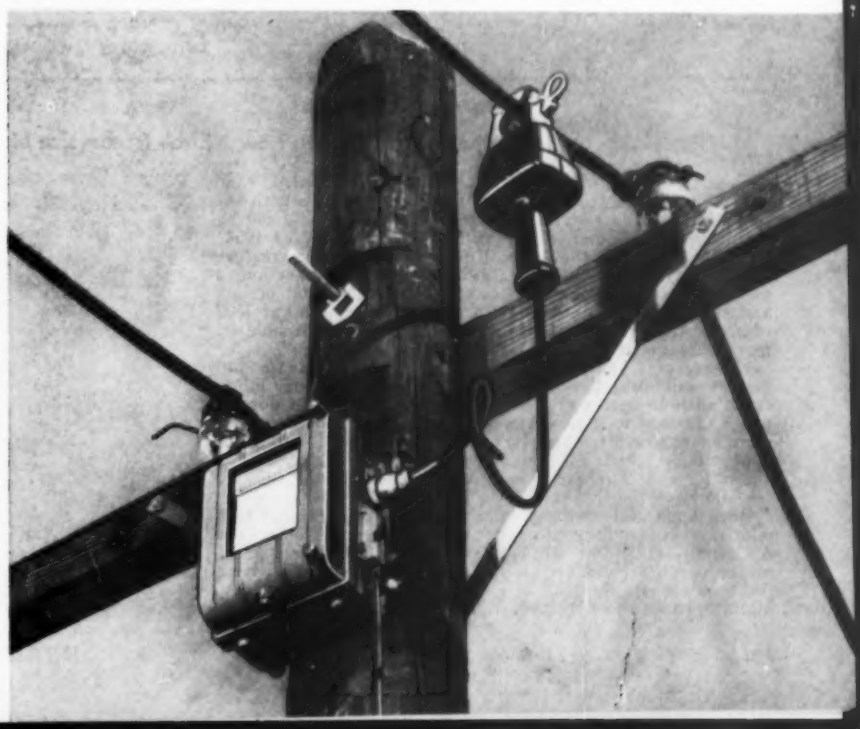
MINIMUM SERVICING

Consisting of a hook-on current transformer, connecting lead, and inkless recorder, this new instrument offers you:

- Inkless recording for minimum servicing, clean records;
- Weatherproof construction for outdoor and indoor use;
- Accuracy to 3% of full scale (4% above 625 amperes);
- Seven ranges—15/75/150/750 amperes, 150/300/750 volts.

See the CF-7 hook-on recorder at the Plant Maintenance and REA shows in January. For full details, contact your Apparatus Sales Office, General Electric Company, Schenectady 5, N. Y. 602-267

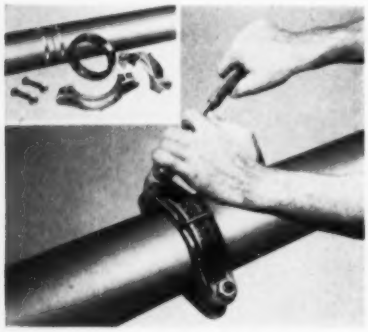
SELF-SUSPENSION of the current transformer is made possible by a spring latch. Self-locking simplifies installation in such applications as checking of line loads.



new equipment

—Starts on page 8

vertical, or inverted position. Also available are manually operated, interphase mechanism assemblies that may be direct or indirect connected, with or without outboard bearings. Because of its mechanical flexibility, the interphase mechanism assembly permits angular distortion of mounting structures which heretofore would have prevented this class of equipment from operating.



Coupling for grooved pipe is lightweight and inexpensive

M16 Gruvajoints have been designed by Gustin-Bacon Manufacturing Co. to save time, weight, freight, and space in coupling grooved pipe systems where pressures do not exceed 500 lb per sq in. The original cost is said to be approximately 15 percent less than conventional grooved pipe couplings; weight, about 40 percent less. They remain leakproof under end pulls up to 7500 lb; permit layout misalignment up to 3 deg; withstand temperatures between 200 F and -65 F; and can be applied or removed in approximately one minute. The couplings, suitable for permanent or temporary lines, are available in 2, 3, and 4 in. sizes.

Cable splice tape is acid resistant

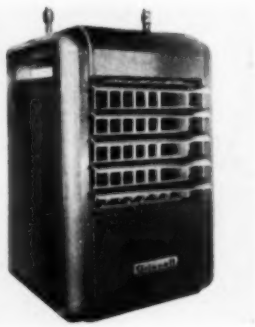
M18 Introduced several years ago to the communications field, CSI cable splice rubber tape is being made available to utility, power, and industrial fields by Central States Industrial Supply Co. Among important features are its imperviousness to copper through special blending; 19,000 volt dielectric strength; and its acid resistance and anticorrosive effect. Said to be completely waterproof, the tape has extreme cohesive properties making it possible to apply the tape lengthwise by pinching. It comes in standard ¾ and 2 in. 15 ft rolls and special sizes. Bulletin and free sample available.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 94/95. Your requests will be handled promptly.

Folding end frame for scaffold goes through 16-inch opening

M19 A sectional scaffold end frame, with hinged legs for folding into a complete and compact unit that easily passes through openings as small as 16 in. dia, is being marketed by The Patent Scaffolding Co., Inc. Designed for use with Trouble Saver Sectional Steel Scaffolding, the end frame meets the problem of erecting scaffolding for maintenance and repairs inside oil tanks, boilers, furnaces, water tanks, and similar closed equipment with small interior openings. Weighing only 47 lb, the end frame has a safe 2000 lb working load.



Gas-fired unit heaters are quiet operating

M20 An eight-model line of gas-fired unit heaters for automatic, direct-fired heating of industrial and commercial areas has been announced by Grinnell Company, Inc. They are available in capacities from 20,000 to 160,000 Btu per hour. The heaters can be used with natural, manufactured, mixed, or liquefied petroleum gases and are equipped with motor driven fans ranging from 1/40 to 1/6 hp, depending upon the capacity of the unit. The fans operate at relatively low speed and have wide blades for maximum air movement with minimum noise. Louvers are individually adjustable for convenience in directing warmed-air output exactly where it is wanted. An automatic safety pilot operates to shut off the gas supply if the pilot burner goes out.

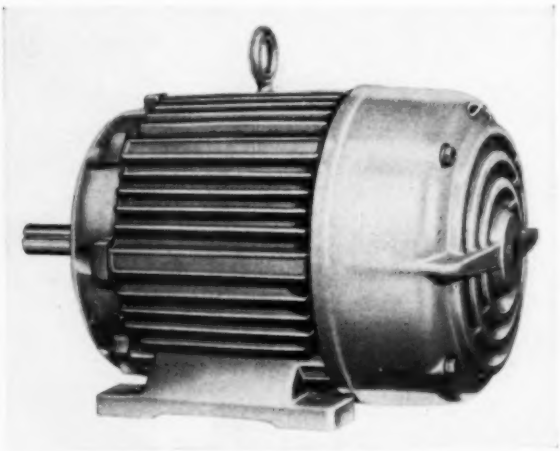
Motors built to new NEMA frame size standards

M17 Open drip-proof, totally-enclosed fan-cooled, and explosion-proof motors, built in accordance with the new NEMA frame size standards, have been announced by the Louis-Allis Company as available by January of 1954.

To be known as the L. A. Line, the new motors feature modern styling, improved ventilation, greater protection, a new conduit box arrangement, new bearing construction, and more versatile mounting. In ratings up to 40 hp at 3600 rpm, these a-c motors pack more horsepower into a smaller, more functional package.

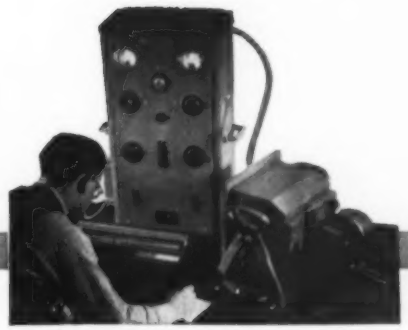
Unnecessary, inactive material has been eliminated to make possible the lighter weight. Bearings are factory lubricated with an ample grease storage reservoir and in normal usage are said to give years of satisfactory service without maintenance or attention. In models of the open, drip-proof construction, cooling air enters at one end and exhausts at the other end. This provides a well-enclosed motor suitable for any mounting position.

Both open and enclosed motors have a split-conduit box which separates into halves for easy electrical connection. An alternate conduit arrangement for the open, drip-proof motor permits omission of the conduit box entirely where the motor must be used in crowded quarters. Open L. A. motors are said to be more drip-proof than previous units.



SMALL PLANTS, TOO!

CAN PROFITABLY USE THE *Nalco* SYSTEM



X-Ray equipment, used in the Nalco Laboratories as an aid toward providing positive water treatment results.

● *Water treatment service for small plants is an important part of Nalco's business.*

This indicates two things:

Small plants find Nalco Service Agreements a profitable investment . . . And

Nalco facilities and services are geared to handle — efficiently and economically — the needs of *any* plant, regardless of its size or the volume of water treatment chemicals used.

If your plant is a small one, you can get the same security from water treatment difficulties as many of the world's largest steam generating stations have with Nalco Service Agreements — and at a cost entirely in line with the size of *your* plant and your problems. Write today for complete details, or call your Nalco Representative.

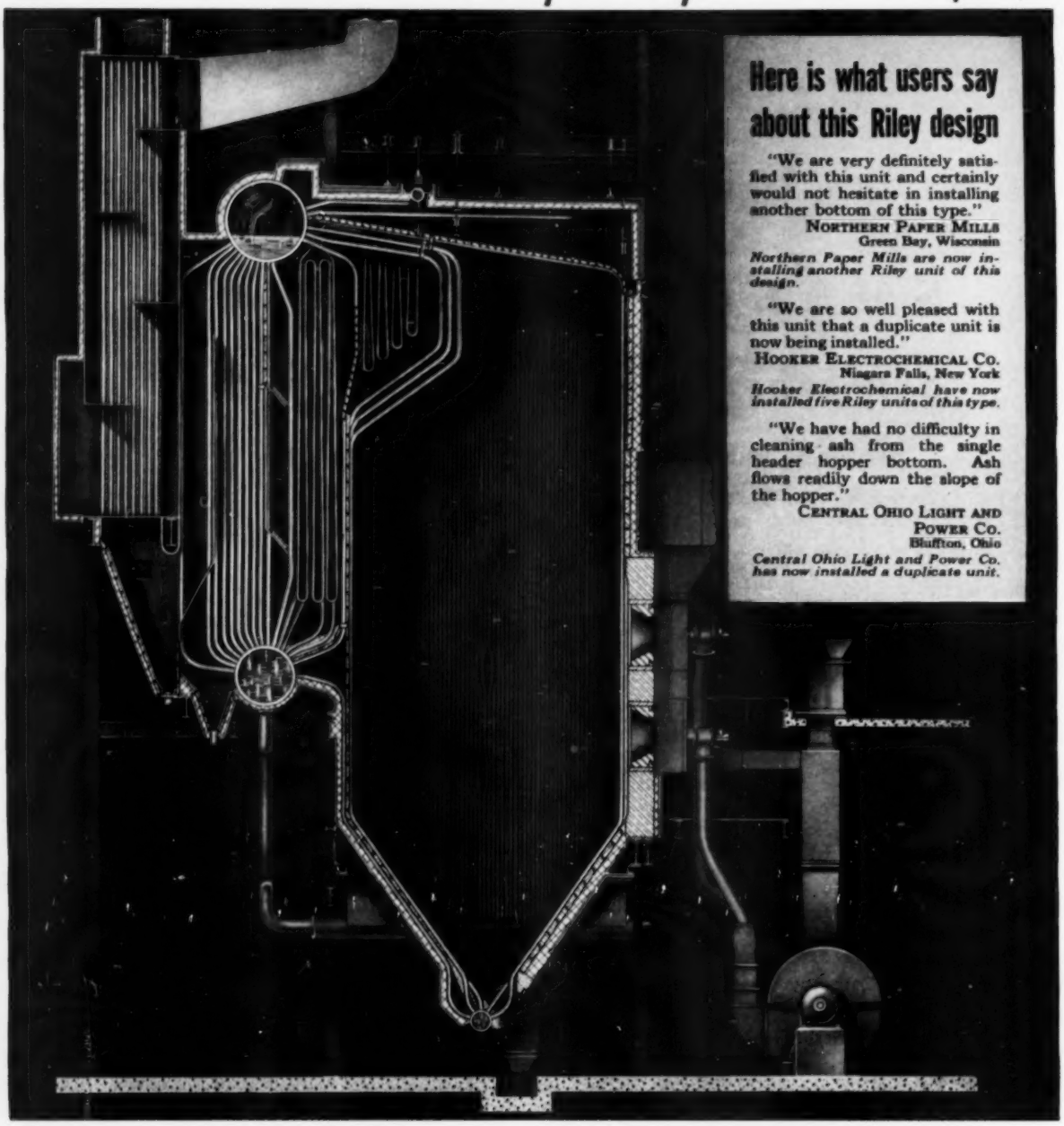
NATIONAL ALUMINATE CORPORATION
6218 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Alchem Limited, Burlington, Ontario, Canada

THE *Nalco* SYSTEM . . . Serving Industry through Practical Applied Sciences

Circle 507 on Reply Card for more data

You save in many ways when you



Here is what users say about this Riley design

"We are very definitely satisfied with this unit and certainly would not hesitate in installing another bottom of this type."

NORTHERN PAPER MILLS
Green Bay, Wisconsin

Northern Paper Mills are now installing another Riley unit of this design.

"We are so well pleased with this unit that a duplicate unit is now being installed."

HOOKER ELECTROCHEMICAL CO.
Niagara Falls, New York

Hooker Electrochemical have now installed five Riley units of this type.

"We have had no difficulty in cleaning ash from the single header hopper bottom. Ash flows readily down the slope of the hopper."

CENTRAL OHIO LIGHT AND POWER CO.
Bluffton, Ohio

Central Ohio Light and Power Co. has now installed a duplicate unit.

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Charlotte · Atlanta · New Orleans · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • ECONOMIZERS

install this unique Riley Boiler Unit

designed for pulverized coal firing

YOU SAVE COST OF SEPARATE HOPPER

Since a water-cooled ash hopper is an integral part of the furnace with this Riley design, by installing it, you not only save the initial cost of a separate hopper but also the cost of hopper foundations and supports as well as future hopper maintenance.

YOU SAVE COST OF HOPPER SEALS

On units requiring a separate ash hopper, seals must be provided between the boiler unit and ash hopper to prevent air infiltration. With this Riley unit, you not only eliminate the difficulties of providing and maintaining positive seals but also the cost of them.

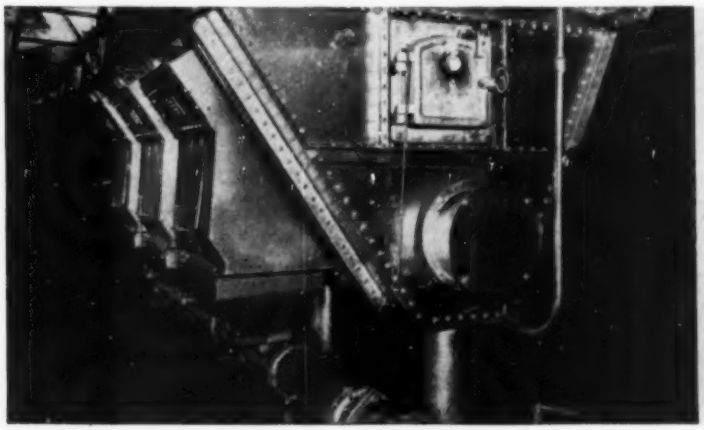
YOU SAVE IN BUILDING COSTS

For a given steam capacity and furnace width, over-all height of the unit is reduced by at least five feet resulting in large savings in building cost if new building is involved or permitting installation or larger capacity units in existing building.

SPONTANEOUS ACCEPTANCE BY ENGINEERS

Thirty-five of the country's leading consulting engineering companies have engineered boiler installations involving Riley units of this type. Engineers have selected this type of unit for over 85% of all Riley pulverized coal-fired installations, purchased since 1948.

Photo below shows Hopper Construction and Ash Conveying System.



Since the first Riley unit of this type was installed in 1946, 137 units have been sold having a steam generating capacity of over 20,000,000 lbs. per hour.

These users have expressed their satisfaction by placing repeat orders with Riley.

Hooker Electrochemical Co.
Celanese Corporation of America
United States Steel Co.
Monsanto Chemical Co.
Esso Standard Oil Co.
Pratt & Whitney Aircraft Corp.
City of Holyoke
Syracuse University
Central Ohio Light & Power Co.
Western Colorado Power Co.
Riegel Textile Co.
Northern Paper Mills
City of Rochester, Minnesota
Cities Service Oil Co.
Dairyland Power Cooperative
Ohio Oil Co.

Other Users

Carbide & Carbon Chemical Co.
Western Electric Co.
Carrier Corporation
Continental Can Co.
South Carolina Electric & Gas Co.
United States Rubber Co.
North American Aviation
General Electric Co.
Goodyear Tire & Rubber Co.
Flintkote Co.
Norton Company
Thomas A. Edison Co.
Colorado Fuel & Iron Co.
White Pine Copper Co.
Chase Brass & Copper Co.
Hanna Furnace Corp.
Calumet & Hecla Consol. Mining Co.
C. H. Masland & Sons
American Viscose Co.
Great Lakes Steel Co.
Bird & Son, Inc.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

Circle 508 on Reply Card for more data

Modern power plant practice demands a water conditioning program that produces only the ultimate in trouble-free and efficient boiler operation.

External softening and the use of conventional inorganic treatments are recognized requisites. However, the supplementary use of organic agents may well assure the difference between long, uninterrupted operation and frequent boiler outages due to scale and sludge formations.

Take the case, for example, of a large electrical manufacturer, who called in Betz 14 years ago to treat its new power plant. This plant operates at 900 pounds pressure with 50% make-up polluted river water. Betz recommended the use of organic agents to supplement the external softening and inorganic treatment.

Here are the results from the record: In the entire 14 years operation of these boilers, they have never been turbined or acid cleaned and no difficulties from feedwater conditions have occurred! What's more, excellent steam purity is produced and turbine blading is completely clean.

This plant could easily be your plant—operating efficiently, free from frequent boiler outages through the effective use of Betz *Specialized* Water Conditioning Service. Why not call on Betz today for an interesting discussion of your water problems? There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

Send today for Betz Technical Paper No. 98, "Boiler Scale—Its Formation and Prevention." It's free.

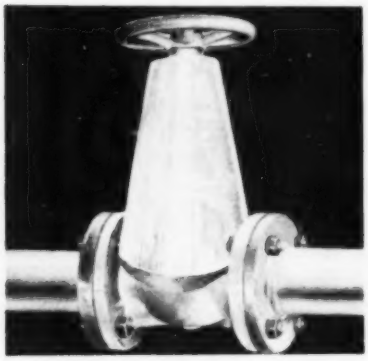
BETZ

CONSULTANTS ON ALL WATER PROBLEMS

Circle 509 on Reply Card for more data

new equipment

—Starts on page 8



Valve bonnet shield affords visual leak detection

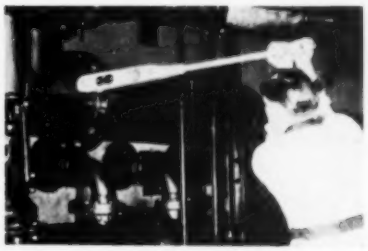
M21 Made of polyethelene plastic, Wilplac Valve Bonnet Shields withstand most acid and corrosive conditions, according to the manufacturer, Wilmington Plastics, Inc. They offer protection against dust and grime, can be installed or removed easily, and are both re-useable and transferable. Transparent characteristics and design make possible immediate detection of leaks and aid in protection of employees and equipment. The valve may be installed without removing the hand wheel.

Use of air connector eliminates bottle-neck

M22 For air hose coupling on paint spray guns and other air-operated equipment, the Q-D Connector, announced by Binks Manufacturing Co., is said to provide almost complete free flow of air to the tools. The connector has full 360 degree swivel action and eliminates the possibility of stripping thread while connecting the air hose. The unit is easy to put in place and to disassemble. It is made for standard air hose sizes and will fit all Binks' units. A bulletin is available.

Valve lowers pressure quickly

M23 The Remotor, a depressuring safety valve announced by Farris Engineering Corp., is designed to rapidly depressurize vessels in event of an emergency. It also functions as an "unloader" for those applications where this feature can be combined with a safety valve. The depressurizing component is interchangeable and can be mounted on other Farris safety valves, already installed. It is said to operate under such conditions as fire, freezing, and current failure. The valves are available with standard depressurizing motors in valve sizes from 1 x 1½ to 2½ x 4 in. and with extra power motors in valve sizes 3 x 4 to 8 x 10 in.

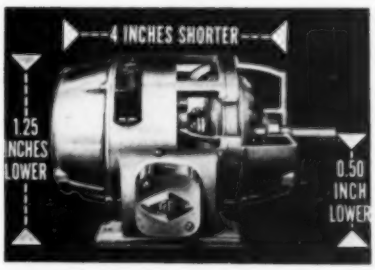


Torque wrench dial holds reading after tension is released

M24 To accurately tighten nuts to any predetermined stress during the construction or servicing of equipment in plant or field, Manzel-Division of Frontier Industries, Inc., is now offering a torque wrench with a capacity from 0 to 1000 ft lb. The Stay Set dial registers torque reading and remains at maximum after tension is released. The dial is reset simply by turning the center knob.

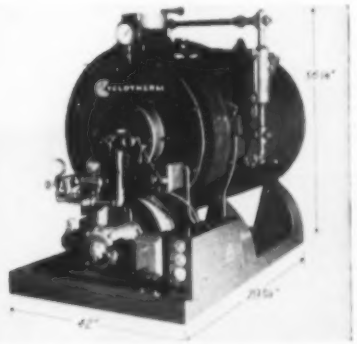
TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 94/95. Your requests will be handled promptly.



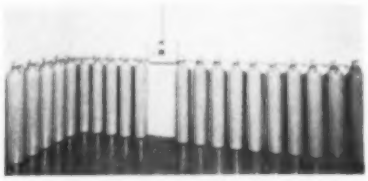
Small fluid-shaft motors feature midget fluid coupling

M25 Fluid-Shaft motors, in frame sizes as low as No. 203, developed by the Reuland Electric Company, incorporate a newly designed midget fluid coupling for use on ratings from ½ through 1 hp. The internal coupling feature is said to greatly reduce both the cost and space required by separate units. Smooth load acceleration; protection against equipment jamming; and an ability to start heavier loads than standard motors of the same horsepower, are additional features. Fluid-Shaft motors are available in standard frame sizes from No. 203 through 326 and in ratings from ½ hp through 15 hp.



Smaller steam boiler requires no cement foundation

M26 Only 20-sq ft of floor space and less than 5 ft of head room are needed for the 50 hp fire tube steam boiler manufactured by Cyclotherm Division of United States Radiator Corp. Known as C1725, it requires no cement foundation or stack. A flue vent is said to be all that is necessary to operate it at about 80 percent efficiency. Multiple unit installations can be made. The package unit weighs only 3550 lb.



New manifolds allow flexible cylinder arrangement

M27 The line of Oxweld stationary manifolds, introduced by Linde Air Products Co., a Division of Union Carbide and Carbon Corp., offers a wide choice of both single-regulator (M-25 Series) and dual-regulator (M-20 Series) manifolds. In the dual-regulator series the reserve bank of cylinders picks up the gas load automatically—with no interruption of service—when the usable supply in the operating bank of cylinders is exhausted. Flexibility of design permits adding individual extensions for any number of cylinders. The single-regulator series has one pressure regulator to control flow of gas from both cylinder banks; change-over from depleted to reserve bank is done manually. Separate control valves allow the use of one bank at a time or both at once. Both series include manifolds for various gases.

Air-line separator is completely automatic

M28 The Wilkerson Corporation announces a major improvement in series 1002-A automatic air-line separator. The redesigned separator is

new

WIDER VISION

for easier remote boiler water level readings

Yarway Remote Water Level Indicator is of the manometric type with automatic temperature compensation. Note new "wide vision" face See Yarway Bulletin WG-1823.

■ Vastly improved visibility of remote boiler water level readings can now be enjoyed by boiler plant operators.

The new "wide vision" face on Yarway Remote Liquid Level Indicators allows reading from the side as well as the front of the indicator.

Boiler water levels and other liquid levels can be checked from most any position in the control room or wherever the Yarway Indicator is installed.

Indicating mechanism is operated by the boiler water level itself, assuring instant, accurate readings. Indicating mechanism is never under pressure. There are no stuffing boxes.

Over 10,000 Yarway Remote Liquid Level Indicators are successfully used throughout industry—primarily for indicating boiler water levels, but also other liquid level applications, and for super-heater pressure differential indication aboard ship.

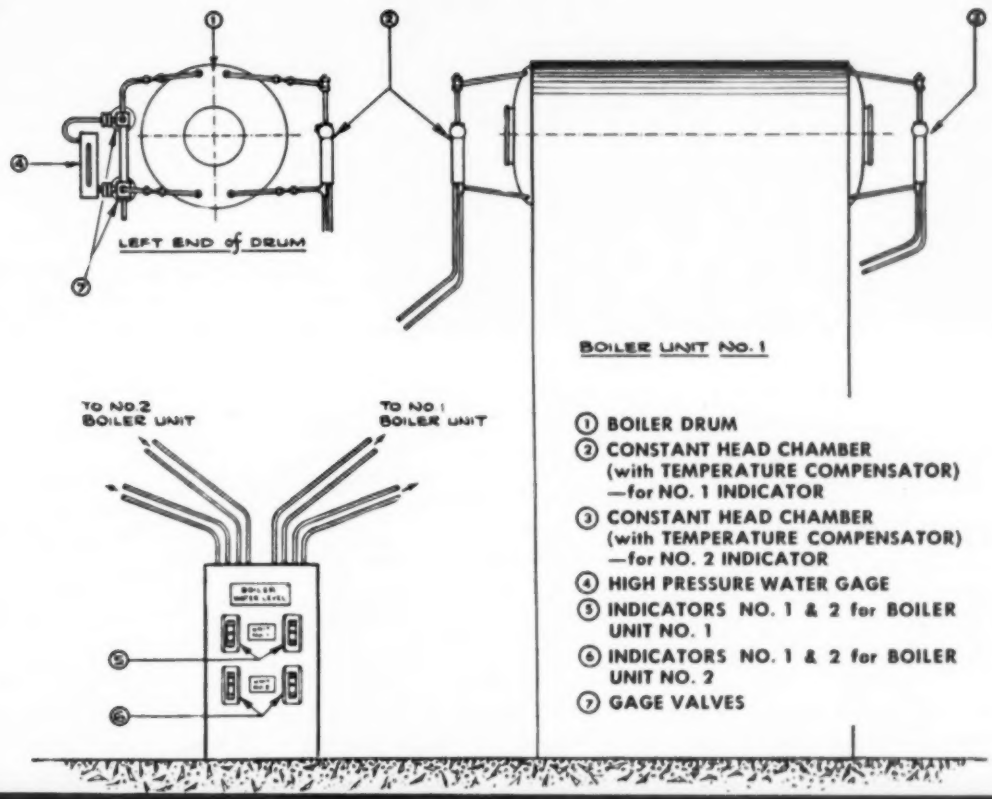
APPROVED MANOMETRIC TYPE

Yarway Remote Liquid Level Indicators are of the manometric type, with automatic temperature compensation, as approved for use under the new ruling of the A.S.M.E. Boiler Code Committee as covered in Code Case #1155, which permits the use of two remote indicators in place of one of the high pressure boiler water gages on boilers over 900 psi.

Additional information—write

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

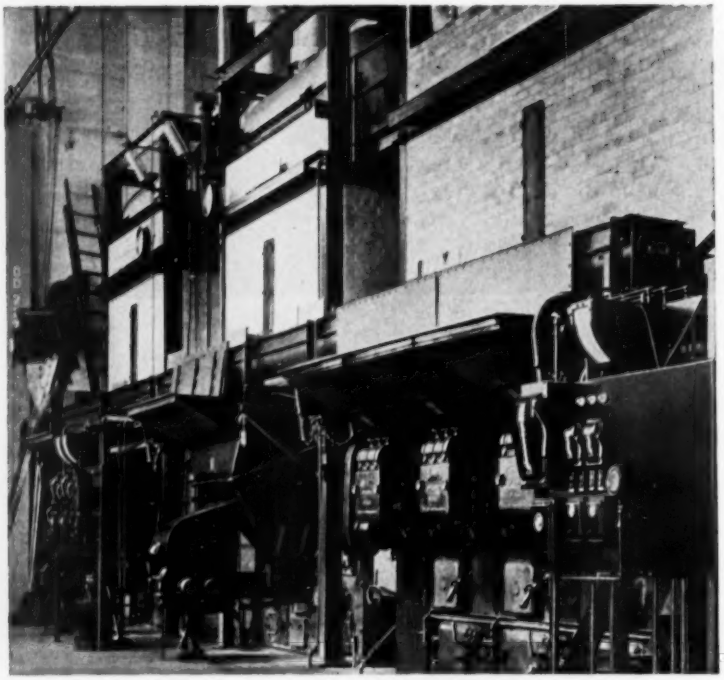
Suggested installation of Yarway Remote Liquid Level Indicators and High Pressure Water Gages as now permitted by the A.S.M.E. Boiler Code.


LEFT END of DRUM
BOILER UNIT NO. 1
TO NO 2 BOILER UNIT
TO NO 1 BOILER UNIT
① BOILER DRUM
② CONSTANT HEAD CHAMBER (with TEMPERATURE COMPENSATOR) —for NO. 1 INDICATOR
③ CONSTANT HEAD CHAMBER (with TEMPERATURE COMPENSATOR) —for NO. 2 INDICATOR
④ HIGH PRESSURE WATER GAGE
⑤ INDICATORS NO. 1 & 2 for BOILER UNIT NO. 1
⑥ INDICATORS NO. 1 & 2 for BOILER UNIT NO. 2
⑦ GAGE VALVES

YARWAY® remote liquid level indicators

Circle 510 on Reply Card for more data

WHY EUCLID SWITCHED TO COAL!



"We cut costs and provided our expanding plant with a flexible heating system by burning coal instead of gas,"

says D. L. Lawrence, Plant Engineer
The Euclid Road Machinery Co.
Cleveland, Ohio

"Upon expanding our St. Clair Plant, we found we could save money by replacing our gas-fired heating system with a modern coal-burning installation. After we made this change, our plant again doubled in size. Yet the stoker-fed boilers shown on the left continued to supply all our heating needs."

Additional case histories, showing how other types of plants save money by burning coal with modern equipment, are available upon request.

What does it cost you to operate your steam plant?
Chances are that, unless you've modernized in the past few years, you could reduce that cost substantially with modern, bituminous coal-burning equipment.

Modern combustion equipment can give you 10% to 40% more steam from a ton of coal. Up-to-date coal and ash handling equipment can cut your labor costs and provide you with a clean, convenient, dust-free operation.

And with bituminous coal, you will continue to enjoy these advantages for years and years.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

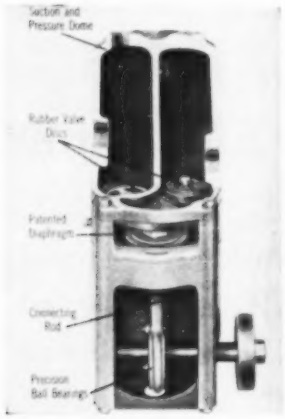
YOU CAN COUNT ON COAL!

Circle 511 on Reply Card for more data

new equipment

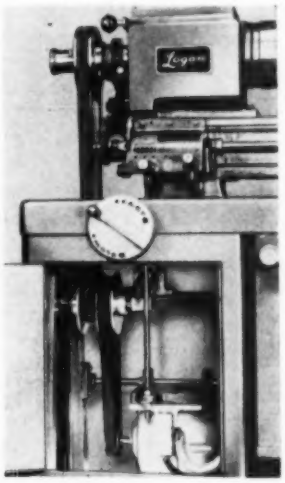
—Starts on page 8

said to offer unlimited service life even under the most unfavorable conditions; separating and discharging all non-gaseous contaminants from any air line without attention by plant personnel. Sizes available are for ¼, ⅜, and ½ in. air lines.



Working parts of pump do not contact fluid

M29 Diaphragm pumps of simple design have been developed by W. S. Rockwell Co. for use in industries where easy cleaning is important and for the pumping of products difficult to handle and destructive to the working parts of ordinary pumps. There is no contact between the pumping mechanism and the fluid handled, since the chambers for each are separated by a rubber diaphragm. The entire working assembly consists of the diaphragm, connecting rod, and crankshaft. The ball bearings are grease packed and sealed at the factory for life and the entire construction disassembles quickly, without need for special tools.

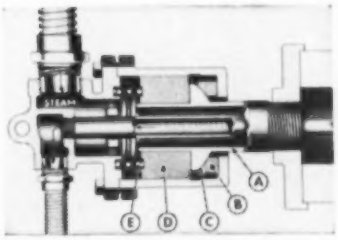


Variable speed drive available with small lathe

M30 On all models of its 12 in. lathe line Logan Engineering Co. now offers the standard double V-belt drive on a variable speed transmission. The time-saving speed correction of the variable speed transmission, and its flexibility in providing continuous optimum speeds, is said to assure more efficient and profitable operation and reduced costs. In back gear, the speed range is 38 to 295 rpm; in direct drive, the range is 250 to 1575 rpm. To obtain the correct speed, the operator simply turns the control handle while the lathe is running. A catalog gives more complete information.

Chainless conveyor system uses no lubricants

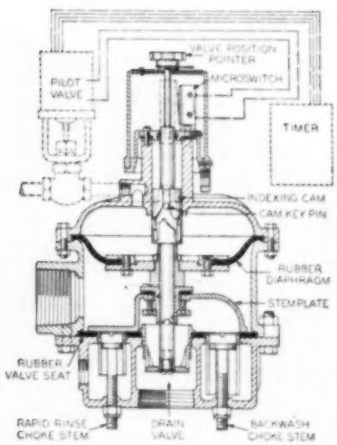
M32 Carburizing the socket and ring assembly of the Landahl chainless conveyor eliminates the need of any lubrication throughout the entire system, according to the manufacturer, the Landahl Conveyor Company. This innovation is said to make it an ideal overhead system for handling any material or product which would be damaged from dripping grease. Because temperatures as high as 700 F have little effect on the working parts of the system, it is especially well suited for oven conveyor service. The system also sharply reduces the fire hazard inherent in grease-packed overhead conveyors. Bulletins are available.



Self-supporting joint features less weight, size, and longer life

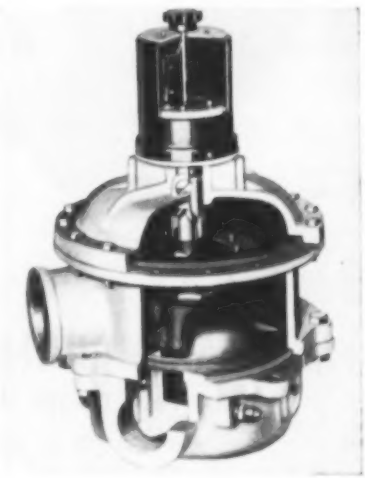
M33 Series 2000 Type S self-supporting Johnson Joint, for admitting steam or other fluids into the rotating rolls and cylinders of paper, textile, rubber, and similar machines, has been redesigned, according to manufacturer,

Guesswork of hand-operation eliminated with control valve



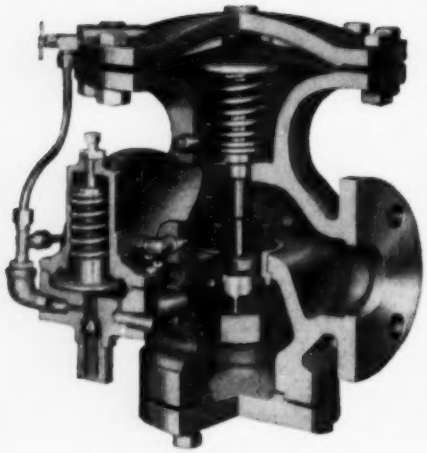
M31 A two-inch multi-port valve for automatic regeneration cycle control of commercial and industrial water softener, filter, and ion-exchanger systems is announced by Automatic Pump & Softener Corp.

Regulated by automatic electrical controls and operated by time clock, the entire regeneration cycle can be accomplished without supervision during off-work hours, or, two or more systems can be automatically coordinated to provide a constant supply of treated water for round-the-clock operations. The simplified design requires only one moving unit in the valve... the stemplate can assembly. This is raised completely from the resilient rubber seat before indexing to do away with troublesome scoring and damage to the valve seat. Sediment and foreign matter are flushed clear each time the stemplate cam assembly is indexed. For periodic servicing, the entire assembly is easily accessible by simply removing the bonnet cover.



Men Who Know Plant Engineering

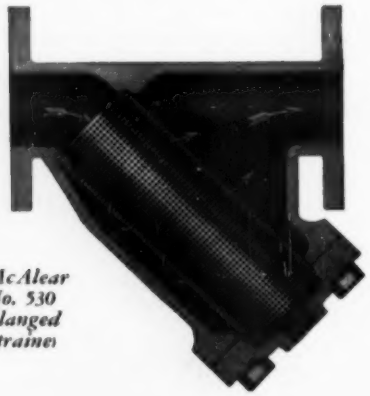
KNOW THE VALUE OF EXPERIENCE AND ENGINEERING "KNOW-HOW"



McAlear 228 Pilot-Operated Pressure Reducing Valve

Behind each unit of McAlear control equipment is a half-century of specialized engineering experience reflected in an enviable reputation of dependable service!

The No. 228 Pilot-Operated Pressure Reducing Valve (left) is accurately sensitive and dependable where positive and automatic control of reduced pressure is required in steam service.



McAlear No. 530 Flanged Strainer

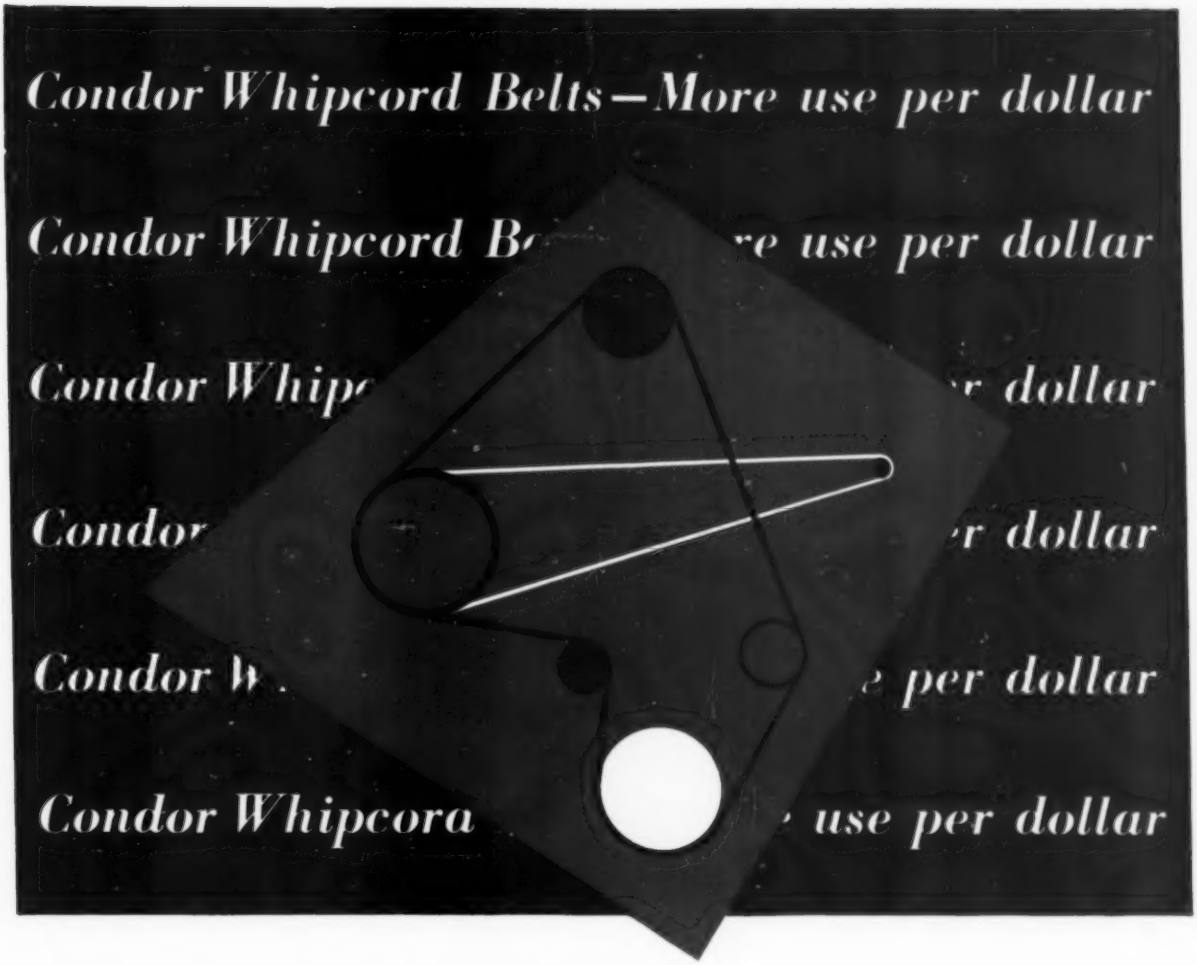
McAlear strainers are recommended for all control valves, regulators, automatic trap installations and other uses where grit and scale are present. They are furnished for any purpose . . . "Y" and basket type construction . . . ½ to 24 inch size range.

Write today for our bulletin No. 228 and No. 128A covering the Pilot Operated Pressure Reducing Valve and McAlear Strainers

McALEAR MANUFACTURING CO.
1901-1921 SOUTH WESTERN AVE.
CHICAGO 8, ILL., U.S.A.

McALEAR
PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE
controls
for STEAM, WATER, AIR, OIL-GAS

Circle 512 on Reply Card for more data

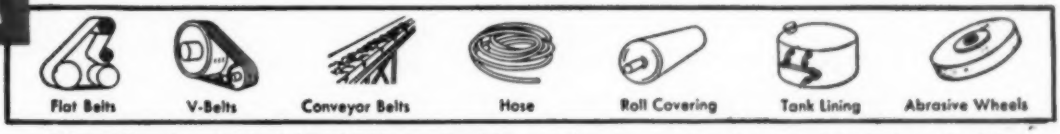


ENDLESS BELTS BUILT TO TAKE THE TURNS . . . Designed for "Belt-killer" drives, Condor Whipcord Belts save you money on all endless belt drives. They are specially engineered for short centers, small pulleys, reverse bends, high speed, high tension. They are practically unaffected by variations in atmosphere—no shrinkage—no stretch on the drive. This saves you downtime for belt take-up. The R/M Extensible-Tip cover-end splice eliminates cover separation. You get MORE USE PER DOLLAR. Ask the R/M distributor for Bulletin 6869. He can help you get MORE USE PER DOLLAR too with R/M hose, conveyor and V-belts.

RM

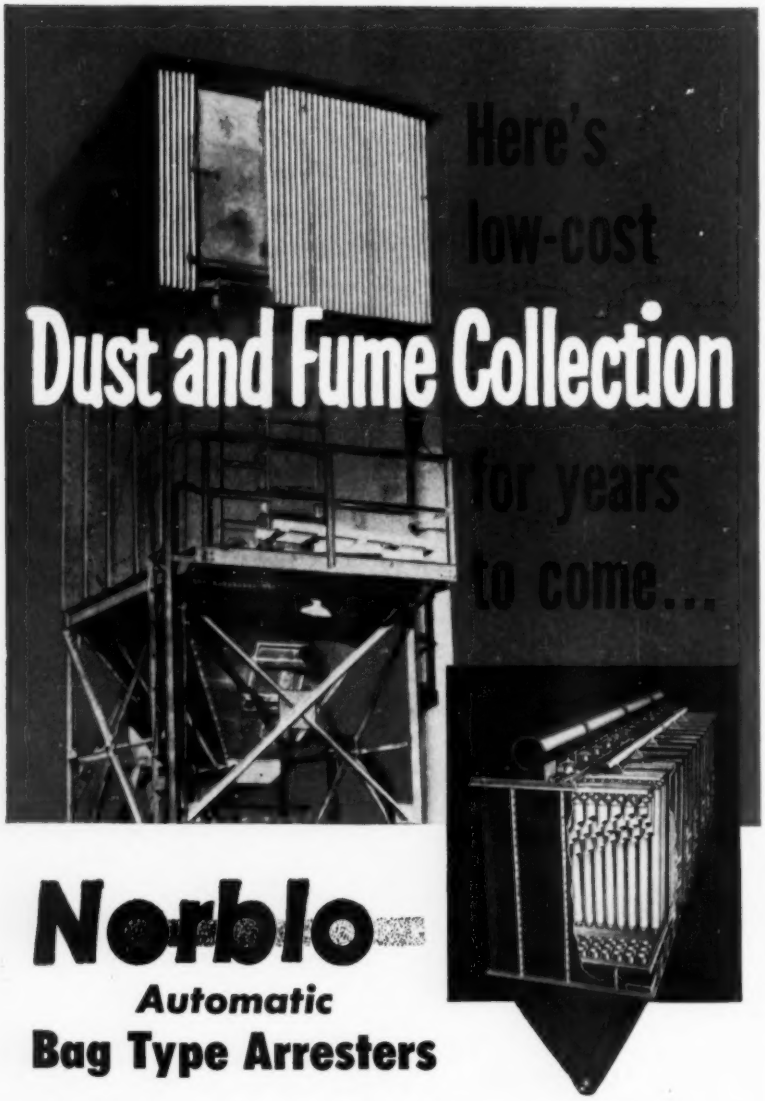
MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.



Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
Asbestos Textiles • Teflon Products • Packings • Sintered Metal Parts • Bowling Balls

Circle 513 on Reply Card for more data



Norblo

Automatic

Bag Type Arresters

Norblo equipment is based on sound, experienced engineering and takes full account of the *scale* of your operation as well as *time* factors, so that Norblo performance can be *guaranteed.*

Norblo arrester design is based on multiples of a basic, standardized compartment. Bag cleaning—fully automatic—is cyclic and periodic, taking only a few seconds for each compartment. In continuous, heavy duty operation, full calculated capacity of Norblo equipment is always available, and investment for equipment of any desired capacity is held to a minimum.

Norblo gives you all four essentials of low cost operation for years to come—advanced design, high efficiency, long life and low maintenance. Write for Bulletin 164-4.

The Northern Blower Company

Engineered Dust Collection Systems for All Industries

6422 Barberton Ave. OLympic 1-1300 Cleveland 2, Ohio

Circle 514 on Reply Card for more data

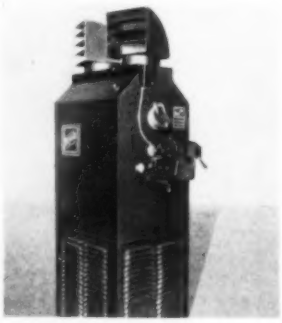
new equipment

—*Starts on page 8*

The Johnson Corp., for lighter weight, smaller size, lower cost, and longer life of the wearing parts. It is for use where suitable supports cannot be provided, and where lateral movement is encountered. Both through flow and syphon pipe type arrangements are offered in a wide range of threaded nipple sizes, for pressures to 150 and 250 lb, and 450 F.

Spring connector has small diameter

M34 Two new sizes of the Scotchlok electrical spring connector for making splices in electrical wiring have been introduced by Minnesota Mining and Manufacturing Co. Described as a spring-type connector that can't shake loose and requires no tools, the three sizes in which it is now available, large, medium, and small will cover use on wire sizes from No. 6 to 18 AWG. The small diameter of the connector makes it especially valuable for joining wires in crowded junction boxes.



Space heater is self-contained unit

M35 Light, oil fired warm-air heaters have been added to the Dravo Corporation's line of space heating units. Known as the Paraflo, this unit is manufactured in two models—

Why Link-Belt builds both...

Car Shakers

EASIER ON CARS with minimum noise level . . . thanks to exclusive low-frequency vibration. The Link-Belt Car Shaker helps hopper cars empty themselves. Even hard-packed loads come "broom clean" in a matter of minutes. Especially good for damp, sticky materials. Write for Book 2345.

Rotary Dumpers

BOTTOMS UP . . . empties 90 ton car every 60 seconds or less by simply turning car upside down (including return to upright position)! That's how fast Link-Belt Rotary Car Dumper unloads gondolas. Simple, automatic, foolproof. Takes all open-type cars—any length, width or height . . . up to 90-ton or 120-ton capacity. Book 2048-A has complete data.

Read how you can empty railroad cars fast, gently—at lower cost

YOU'LL get push-button car-unloading with either the Link-Belt automatic Rotary Dumper or the low-frequency Car Shaker. Both of these Link-Belt products can whisk gondola cars "broom-clean" in a remarkably short time.

We build the Rotary Dumper for large users . . . the Car Shaker for smaller operations. That's why you can be sure you get the right railroad car unloader for your particular requirements. Each of these precision-engineered products reduces operational hazards, minimizes injury possibilities, cuts costly demurrage charges.

If you empty a few gondola cars a day—or several thousand a week, call the Link-Belt district office nearest you. Get all the facts on how you can cut your railroad car unloading costs.

LINK-BELT

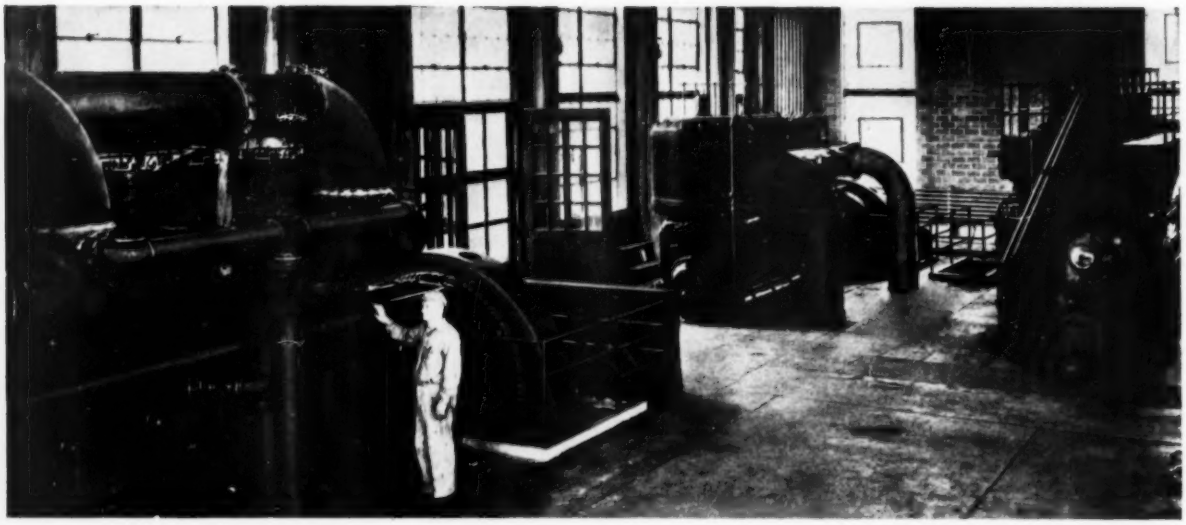
CAR SHAKERS and ROTARY DUMPERS

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales Offices in Principal Cities. 13,202

Circle 515 on Reply Card for more data

H. L. Ostness, Chief Engineer, River Falls Municipal Utility, Wisconsin, says...

"Sticking Rings are no problem in this Plant"



Mr. Ostness, as chief engineer of one of the oldest Municipal Power Plants in Wisconsin, knows diesels – *knows how to get the most out of them.* Mr. Ostness recently wrote, "We have used Sinclair Lubricants for over fifteen years very successfully. GASCON® and RUBILENE® H.D. have been doing an outstanding job in our diesels. Stuck rings is a trouble we know nothing about – engine wear is at an absolute minimum. With results like these, we'd recommend Sinclair Lubricants any time."

If your present lubricants do less, why not let Sinclair help you get longer life from your diesels – with less trouble. Contact your nearest Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR DIESEL LUBRICANTS

save wear and replacement

Circle 516 on Reply Card for more data

new equipment

—Starts on page 8

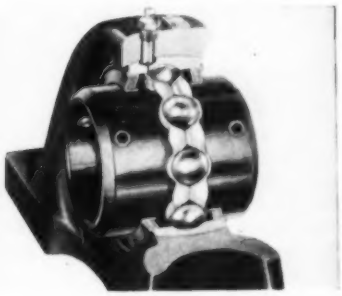
the Model 20 with 200,000 Btu per hr output and the Model 25 with 250,000 Btu per hr output. The completely automatic heater is equipped with gun-type oil burner, and is a compact self-contained unit, completely assembled and flame tested prior to shipment. It operates on 110 v, 60 cycle, single phase power, and burns up to and including No. 2 fuel oil.

Gas-fired unit heater is designed for small space

M36 G-50, compact, gas-fired unit heater with an input of 50,000 Btu per hr, has been added to the line of Young Radiator Co. Designed especially for low ceiling and small space applications, the 23-in.-high heater is direct-fired into the tubes of welded, aluminized steel heat exchanger. The heavy cast iron burners have precision drilled ports for use with manufactured, mixed, natural, LP, or LP air gases. Catalogs give more information.

TO REQUEST ADDITIONAL DATA

Circle "key" numbers on Reply Card between pages 34/35 & 94/95. Your requests will be handled promptly.



Bearings are zone hardened

M37 Zone hardened Sealmaster ball bearing units with double extended race are now being manufactured by the Sealmaster Division of the Stephens-Adamson Mfg. Co. Zone Hardening is a patented process for induction heat treating the inner race ring of Sealmaster units—through the ball path section only. Since the extended portions of the race remain unaffected, the hardened threads of the set screws are able to bind tightly against the soft threads of the race for positive race to shaft locking. The double extension of the inner race ring is said to afford maximum support of bearing on shaft, thus effectively reducing shaft wear and corrosion. Literature is available.

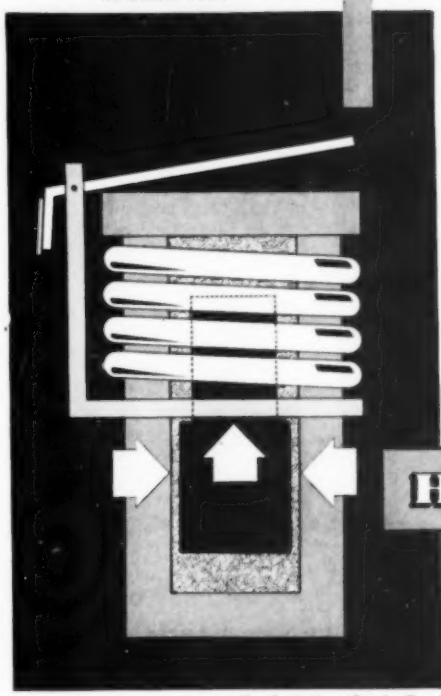
Silic-O-Netic **TIME DELAY RELAYS**

LOW COST and DEPENDABLE

Complete information is available upon request. Write for Bulletin 5001.

Better performance in a time delay relay for your products need not run your costs UP. The basic design of the new SILIC-O-NETIC Time Delay Relay lends itself to Heinemann high production techniques . . . creates savings that are passed on to you as LOWER unit costs.

SILIC-O-NETIC Relays provide other savings, too. As a load carrier in itself, it eliminates the need for a separate load relay. Being small in size, it reduces the overall size requirements of equipment with which it is used. SILIC-O-NETIC Time Delay Relays have only one moving part in the time element, which is hermetically sealed . . . and never requires attention.



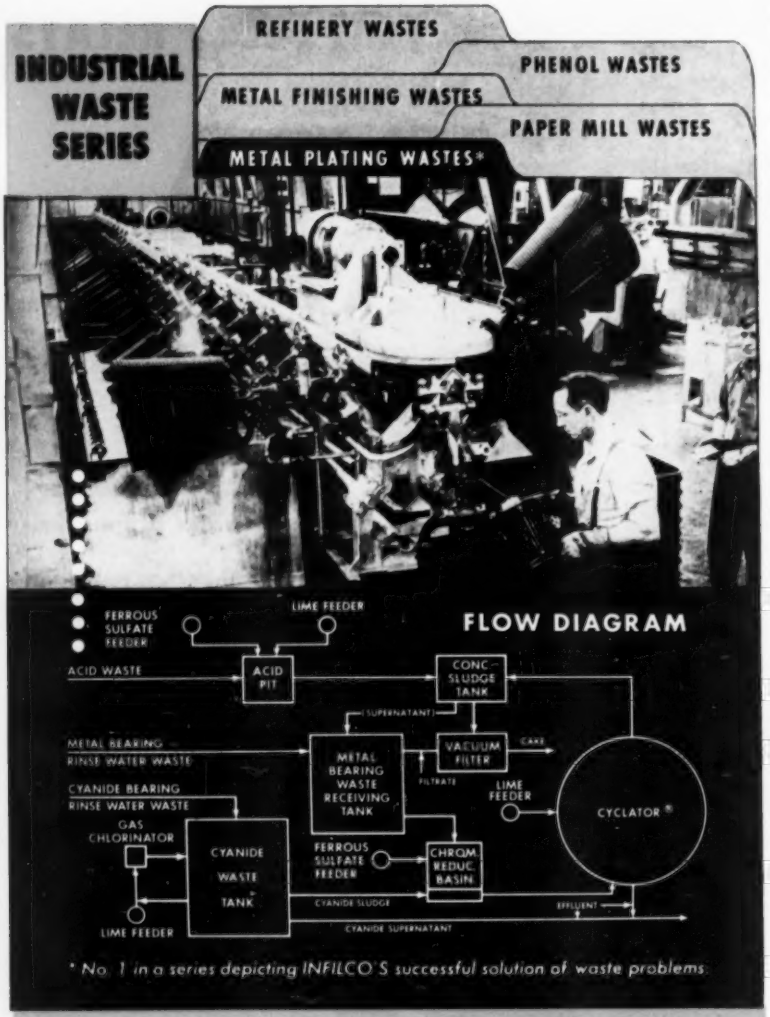
The SILIC-O-NETIC Time Delay Relay employs silicones . . . operates dependably on a hydraulic-magnetic operating principle regardless of position or frequency of operation. Overall size is only 1⅛" x 2½" x ¾".

HEINEMANN

ELECTRIC COMPANY

140 Plum Street, Trenton 2, N. J.

Circle 517 on Reply Card for more data



There is no "cure all" for solving waste treatment problems.

FOR EXAMPLE: our thorough evaluation of your problem could dictate the utilization of ion exchange rather than the precipitation equipment found most practical in the existing plating waste installation diagrammed above.

We invite your specific inquiries and know that our wide experience in all phases of waste treatment will prove helpful to you. Request Bulletin 70-Y.

INFILCO

INFILCO INC. *Tucson, Arizona*

Plants in Chicago and Joliet, Illinois

FIELD OFFICES IN 28 PRINCIPAL CITIES

Circle 518 on Reply Card for more data

letters

. . . from readers

Engineering History

Sir:

It has occurred to us that your readers might like to know about our Goss Library of Engineering History at Purdue University . . . new quarters and the completion of a quarter century of the life of this important historical collection is the occasion for this note to you. The books have been moved from the main university library to the Engineering Adminstration Building.

There are many persons . . . who regard the history of engineering as an almost indispensible part of the engineer's education.

T. R. Johnson
Purdue University
Lafayette, Indiana

Most Benefit

Sir:

After receiving the list of individuals in our organization receiving INDUSTRY AND POWER, we will check it thoroughly and make any revisions or additions which we feel should be made in order to receive the most benefit from your wonderful magazine.

Kenneth P. Mikels
Iowa Southern Utilities
Centerville, Iowa

Major Agreement

Gentlemen:

The article "Can Your Boiler Burn Another Fuel," by Mr. William S. Major in your October, 1953 issue of INDUSTRY AND POWER (page 70), is very interesting and clearly shows the desirability of considering all of the fuels available or likely to become available when designing steam generating plants . . . (This information) demonstrates that the percentage of CO_2 in the flue gases is not a reliable measure of combustion efficiency unless the data shown on these charts are available for the particular fuel being used.

. . . percentage of O_2 in the flue gases for a given percentage of excess air varies very little with the solid and liquid fuels commonly available and consequently is a better measure of combustion efficiency than the percentage of CO_2 . . . (To illustrate this fact) I prepared the enclosed chart showing the relationship between O_2 and CO_2 for two

The smooth, blue interior finish of the new G-E WHITE rigid steel conduit makes fishing and wire-pulling easy.

Easy fishing and wire-pulling with new G-E WHITE rigid conduit

The new G-E WHITE rigid steel conduit is lined with a new corrosion-resistant coating, containing a special antifriction agent. This smooth, blue interior surface lets wires slide easily, and cuts fishing and wire-pulling time.

New G-E WHITE also offers easy bending and improved corrosion protection because it is zinc galvanized by the "metallizing" process. This process bonds a uniform coating of pure zinc to the entire outside surface of the conduit, including threads.

New G-E WHITE metallized conduit, with its completely new interior and exterior finishes, is listed by Underwriters' Laboratories, Inc. Ask your distributor about it, or write Section **C35-1244** Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

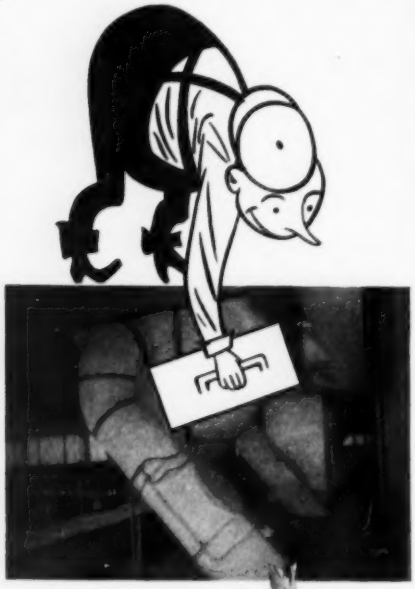
You can put your confidence in—

GENERAL ELECTRIC

Circle 519 on Reply Card for more data

Save With This Matchless ONE-COAT SUPER FINISH Cement . . .

A Light, Efficient Insulation



- *Easiest to Apply*
- *Adhesive*
- *Maximum Coverage*
- *Smooth, White Finish*
- *Hard* ● *No Cracking*
- *Resistant to Abrasion and Water*
- *Ready to Paint or Weathercoat*

Use One-Coat Super Finish Stic-Tite on flanges, valves, fittings, flat or curved surfaces of boilers, fans, tanks and other equipment, whether indoors or exposed to the elements.

Save with R & I Super Finish Stic-Tite—the insulating cement that goes further—lasts longer. 100 lbs. covers 80 sq. ft.—½" thick, or 160 sq. ft.—¼" thick. Can be easily troweled smooth in ONE COAT directly on block, blankets or metal surfaces, air-drying quickly without shrinkage or cracking.

One-coat application saves time and labor.

Super Finish Stic-Tite is low in material cost, low in overall cost, long lasting.

R&I

SUPER FINISH STIC-TITE

Get the Facts — Mail this Coupon Today

REFRACTORY & INSULATION CORP.
130 WALL STREET • NEW YORK 5, N.Y.

Send me a sample bag of Super Finish Stic-Tite and bulletin

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

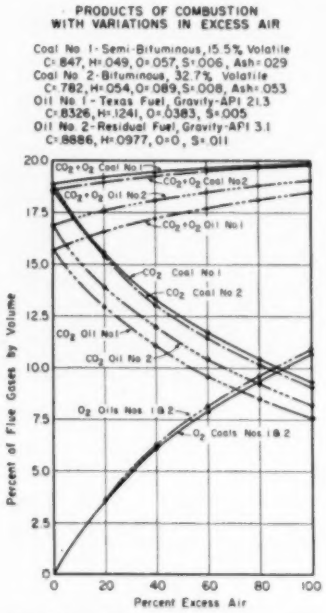
Circle 520 on Reply Card for more data

letters

—Starts on page 28

representative coals and two oils . . . This shows that the percentage of O_2 in the flue gases is practically the same for each of these fuels for the same ratio of excess air. A check shows the percentages of O_2 given by Mr. Major in Table 5 fall on the curve for O_2 in this chart.

William W. Gaylord
Consulting Engineer
Torrington, Connecticut



—An 8½ x 13 in. copy of this chart is available, free of charge, from Industry and Power.

Thank You

Sir:

. . . regarding your open letter in the September INDUSTRY AND POWER . . . you state that "articles . . . will be held to minimum wordage consistent with. . .thoroughness, accuracy, and clarity. . . ." I believe that you have recently achieved this goal fabulously. Your articles are just long enough so that there is something worthwhile in them, even for someone familiar with the field.

Your publication fills a very valuable slot by being less technical and more practical than the usual "journal" material, but more meaty than the "picture" magazines.

Richard LeB. Bowen, Jr.
Coated Textiles Mills, Inc.
Pawtucket, Rhode Island

For power from steam DEALKALIZE WITH

AMBERLITE IRA-410

Without Acids or Degasifiers

Here are the facts about dealkalization with AMBERLITE IRA-410:

1. Alkalinity of water supplies for boiler feed and evaporator coolers may be conveniently controlled at low cost.
2. No acid-resistant or degasification equipment is necessary.
3. Because line pressure is not broken, pumping costs are eliminated.
4. Only low cost salt is required for regeneration—3 to 4 lb. per cubic foot of resin.
5. Combinations of the anion exchanger, AMBERLITE IRA-410, and the cation exchanger, AMBERLITE IR-120, permit simultaneous softening and dealkalization in a single column.

AMBERLITE is a trademark, Reg. U. S. Pat. Off. and in principal foreign countries.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

Washington Square, Philadelphia 5, Pa.

Representatives in principal foreign countries

For more information about dealkalization with AMBERLITE IRA-410, write Dept. P-1 for complete literature. For bi-monthly reports on new developments in ion exchange, ask to receive AMBER-HI-LITES.

HOW ACCURATELY DO YOU MEASURE

EXCESS AIR

IN YOUR FLUE GAS?

Prevent heat loss up the stack. Too much or too little excess air means big money in today's boiler plant. It's important to *know* and *control* excess air exactly—regardless of load or fuel changes.

Burn multiple fuels efficiently

When switching from one fuel to another or burning more than one fuel at the same time, only an Oxygen Recorder gives you an undistorted picture of excess air. It measures O_2 directly and continuously, without recalibration.

Hundreds of companies are reaping large savings with Hays Electronic type Oxygen Recorders in their boiler plants. Flue gas sampling systems fit a wide variety of installations.

With the Hays Electronic type Oxygen Recorder you get continuous, highly accurate indication and recording . . . complete compensation for temperature and pressure effects . . . freedom from chemicals or hazardous fuel burning in the analyzing process . . . swift, sure electronic operation.

Write today for Hays Bulletin 52-829-56. Also ask for a dramatic comparison graph which shows that the relationship between O_2 and excess air is practically constant for different fuels.

Automatic Combustion Control
Boiler Panels • CO_2 Recorders
Veriflow Meters and Veritrol
Gas Analyzers • Draft Gages
Combustion Test Sets
Electronic Oxygen Recorders
Electronic Flowmeters
Electronic Feed Water Controls
Miniature Remote Indicators

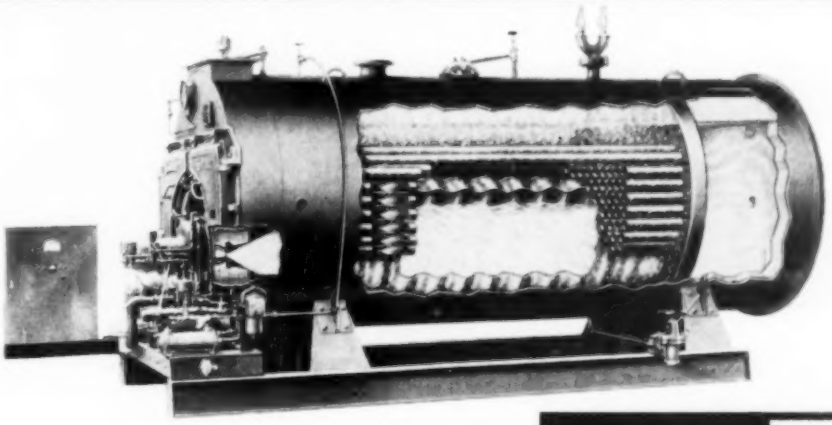
THE hays CORPORATION

MICHIGAN CITY 2, INDIANA

Circle 522 on Reply Card for more data

2 heads are better than 1 ... in designing boiler-burner units

● It is just common sense that experts in any field thoroughly know their own products. So you can expect a better product in every way when you specify the Kewanee-Petro Boiler Burner Unit because you get the combined knowledge of leadership in 2 fields . . . boilers and burners. Here, two great companies bring together boilers and burners designed as complementary units with all parts perfectly integrated. Engineering and design have been combined for maximum efficiency and dependable production of high or low pressure steam and hot water heating using oil, gas or oil and gas combination. The Kewanee-Petro Unit is easily installed . . . simple to operate. The boiler, mounted on steel skids, has matched burner connections. All refractories are installed at the factory . . . forced draft burner eliminates necessity of a high stack . . . operation is completely automatic with all combustion controls mounted and pre-wired in one cabinet. Delivery from two separate factories offers important advantages. The boiler is usually wanted at the building site before the walls are up, and needing no protection from the weather, is shipped first. The burner, with control system, is delivered when wanted, after the building is roofed. It will pay you to get full information on this outstanding boiler-burner unit. Write either company or mail the coupon.



KEWANEE—PETRO

boiler–burner unit

PETRO
3215 W. 106th Street, Cleveland, 11, Ohio

KEWANEE-ROSS CORPORATION
119 Franklin Street, Kewanee, Illinois

PETRO
3215 W. 106th Street, Cleveland, 11, Ohio
KEWANEE-ROSS CORPORATION
119 Franklin Street, Kewanee, Illinois

Please send 16 page catalog containing complete data and specifications.

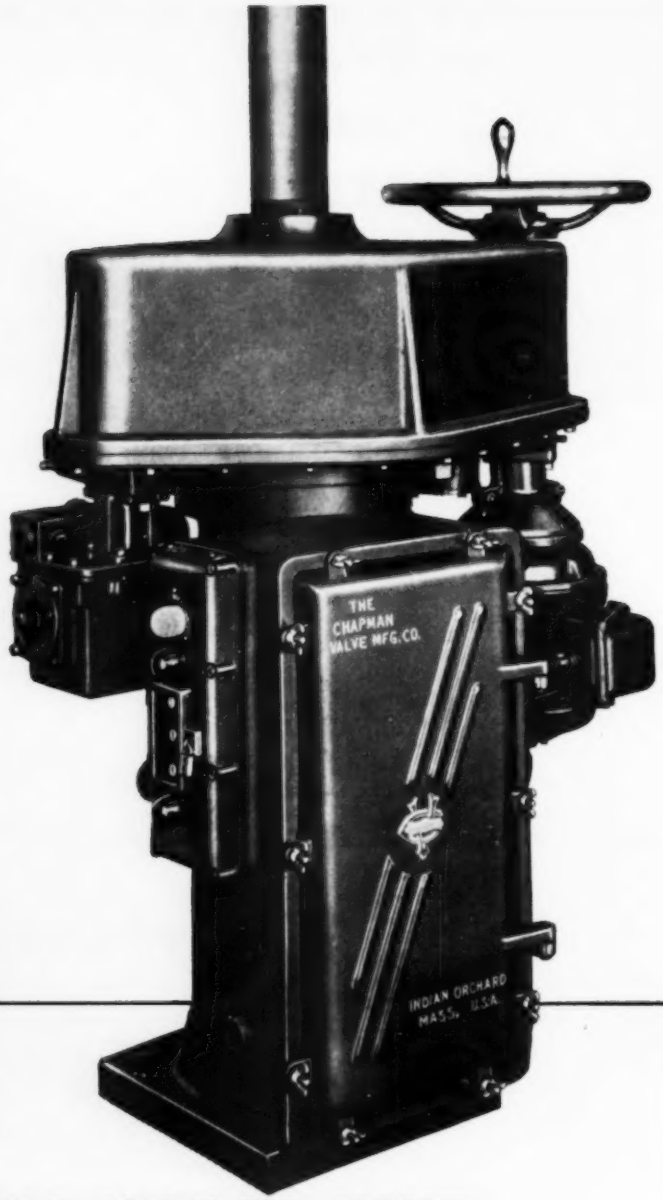
NAME_____

ADDRESS_____

CITY_____ STATE_____

Circle 523 on Reply Card for more data

SMART OPERATOR for Valves, Gates and Floorstands



CHAPMAN'S MOTOR UNIT

Instant control of valves and large sluice gates at the touch of a button . . . that's what you get with Chapman Motor Units on the job. Completely housed and thoroughly dust and weather proof, these units are built "to take it" for years, on the roughest service. They're designed for simplicity and extreme ruggedness, as shown by internal view above.

Chapman Motor Operated Floorstands are delivered to the job with all internal wiring complete, so all the wiring to be done is to bring the power leads into the connection box... saving time and money in installation and assuring proper operation. Write for Catalog No. 50.

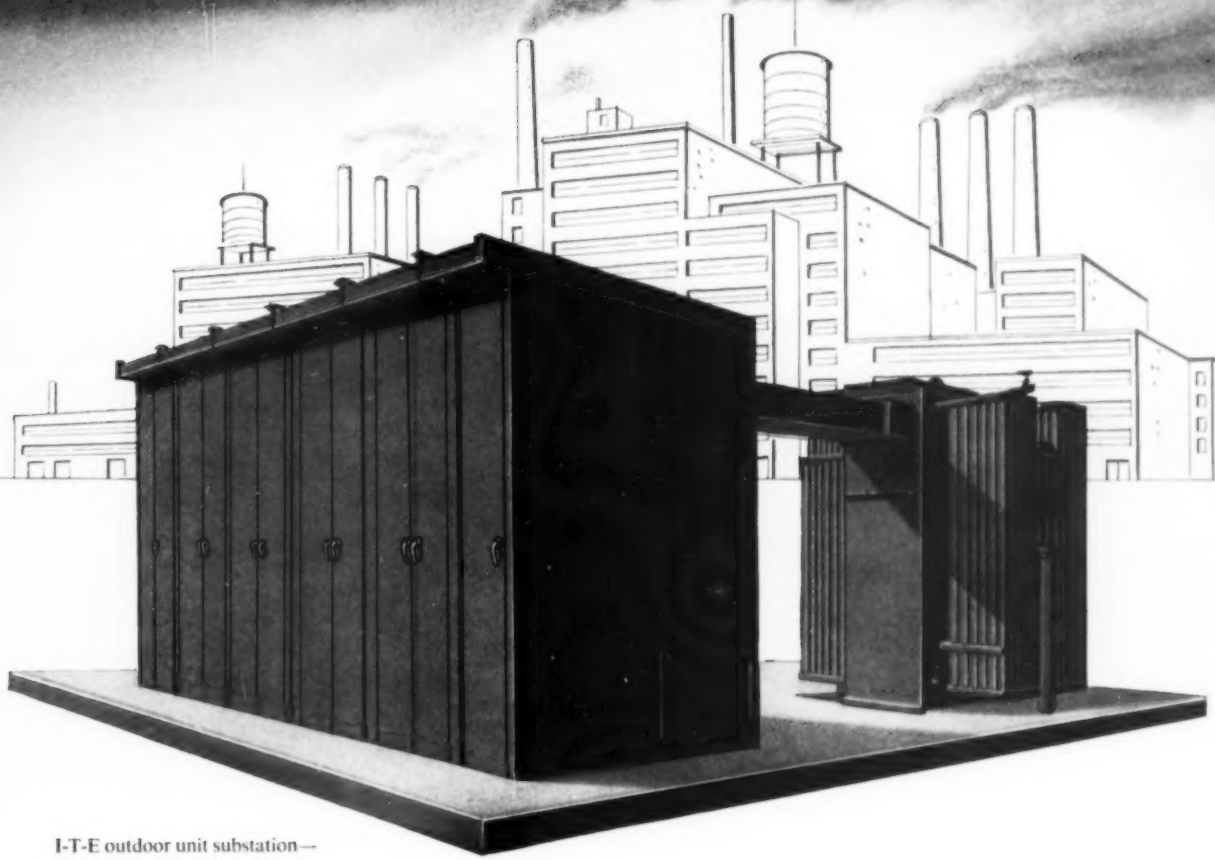
The Chapman Valve Manufacturing Co.

INDIAN ORCHARD, MASSACHUSETTS

Circle 524 on Reply Card for more data

Planned Power Distribution

—first step toward increased plant efficiency



I-T-E outdoor unit substation—outstanding example of power equipment planned for efficiency. This substation, a durable, weatherproof unit of transformer and switchgear, can be located close to load center—yet out-of-doors, where it will not take up premium production space inside the plant.

Power is fundamental. The most modern plant, the latest-type production lines can be only as efficient as the electrical distribution system that feeds them.

Plan ahead now, and avoid "patchwork" later. An I-T-E application engineer will gladly advise you how to get more efficiency from your power devices, how to lower distribution costs, and get positive electrical protection for your plant.

I-T-E METAL-CLAD SWITCHGEAR

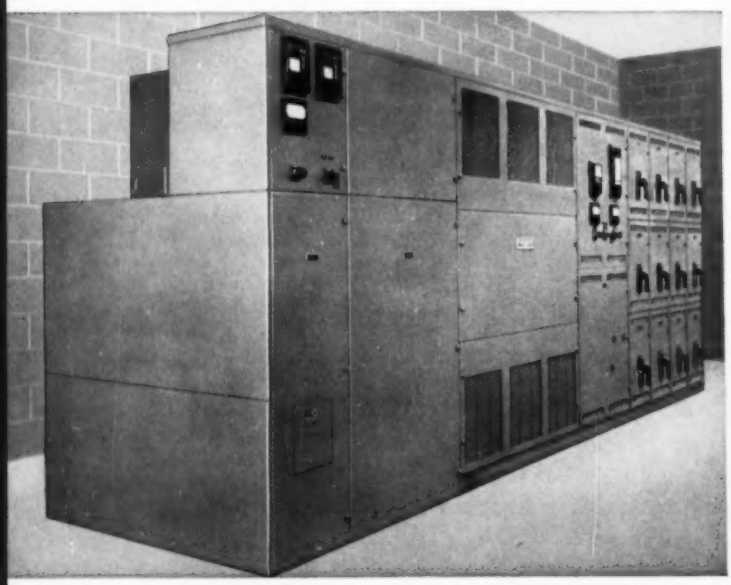
4160 volts — 600, 1200, 2000 amperes
50,000, 150,000, 250,000 KVA interrupting

For protection of main incoming lines and feeders. Modern horizontal drawout construction guarantees savings in inspection and maintenance.

600-VOLT DISTRIBUTION SWITCHGEAR

600 volts — 6,000 amperes and below
15,000 to 100,000 amperes interrupting

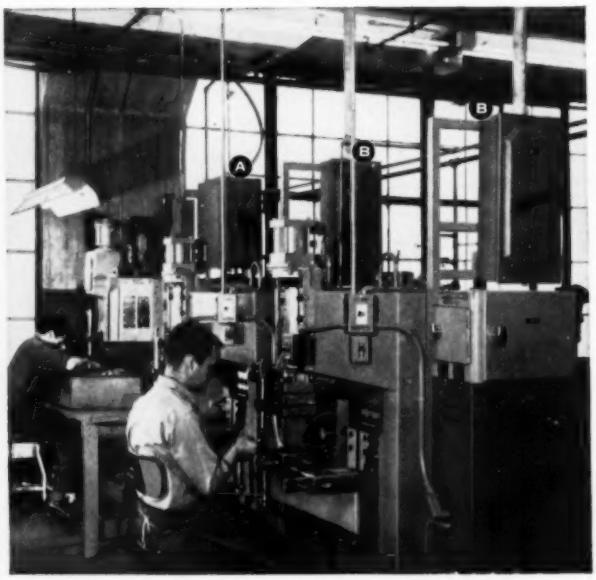
For protection of low-voltage incoming lines and feeders.



UNIT SUBSTATIONS

300 KVA and above—Primary voltage 480 and above

Coordinated Metal-clad and 600-volt switchgear, plus transformer. Substations reduce distribution losses by stepping down voltage near point of utilization.



INDIVIDUALLY-ENCLOSED CIRCUIT BREAKERS

120-600 volts 10-6,000 amperes
5,000-100,000 amperes interrupting

A complete line of large air (**A**), and molded case (**B**) circuit breakers for protection of single circuits to almost any type of plant equipment.

From power line to production line

...I-T-E BOOSTS PLANT EFFICIENCY

From the main plant switchboard to the smallest circuit breaker, I-T-E equipment boosts plant efficiency. Equipment is designed to facilitate efficient power distribution, to guard against overloads and short circuits, and to allow for quick restoration of service in the event of sudden power interruption.

Your plant structure and costly capital equipment are fully protected against electrical hazards at all times. Loads are fed and maintained at proper, efficient voltage. Production lines are kept on the go.

In line with latest thinking, equipment is compact, self-contained—can be located either *indoors* or *outdoors*, according to requirements. Rugged, durable enclosures are available to satisfy every plant need.

Modern design complements modern engineering. Standardized units facilitate expansion. Circuit breakers are easy to get at; maintenance is simple. Breakers can be quickly adjusted to compensate for load changes.

And throughout—safety is the keynote

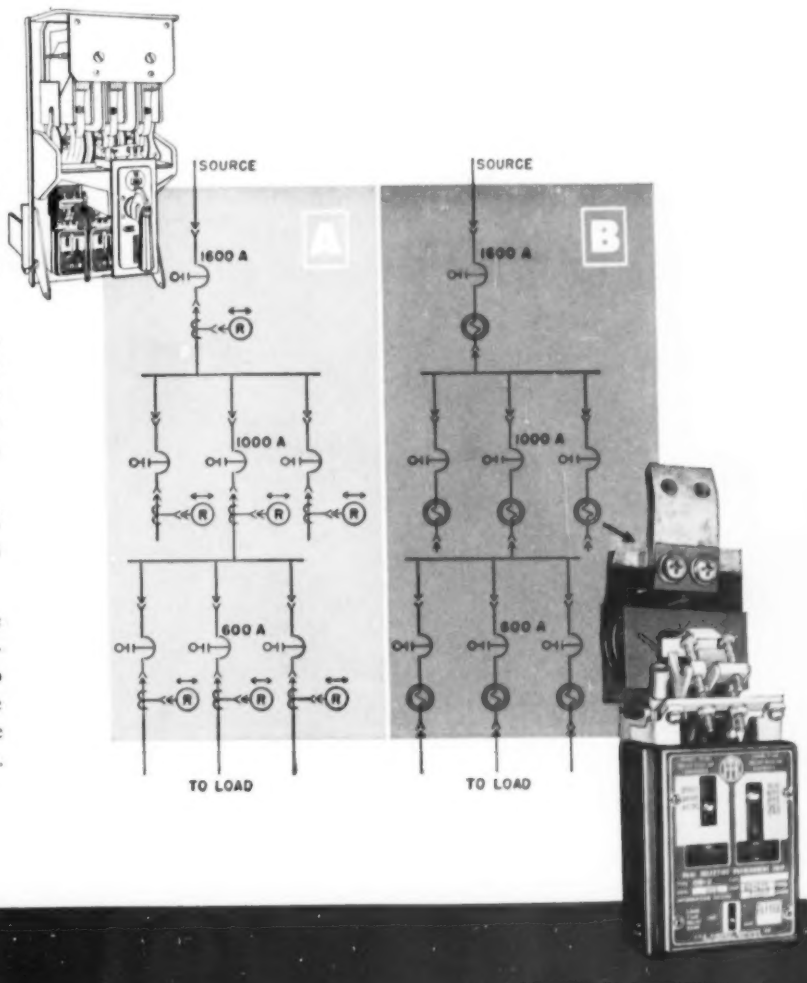
For the *utmost* in service continuity... I-T-E *Selective Tripping*

For those 600-volt switchgear applications in which absolute continuity of service is essential, I-T-E offers an advanced selective-trip device which mounts as an *integral* part of the circuit breaker.

By allowing the circuit breaker closest to a fault to open *first*, while other breakers remain closed, the selective-trip device *localizes* trouble. Thus, batch processes and other critical loads are insured against costly and unnecessary shutdown.

Through use of simple, compact I-T-E selective-trip devices, plants can realize an initial cost saving as high as *60%*!

Although Systems A and B (right) provide the same high degree of selective-trip protection, System B actually costs far less to install. I-T-E Direct-Acting Dual-Selective Overcurrent Trip Devices eliminate separate relays, save space, and reduce maintenance.



I-T-E CIRCUIT BREAKER COMPANY

and if DIRECT CURRENT is in the picture...

THE I-T-E MECHANICAL RECTIFIER GIVES YOU HIGHEST EFFICIENCY:

96%—and higher—from a-c line to d-c bus!

THE SAME INCOMING POWER —BUT 10% MORE CHLORINE!

Fields Point Manufacturing Corp., Providence, R. I., credits two I-T-E Mechanical Rectifiers for this substantial boost in production. Here is an excellent source of savings on power costs.

To obtain the highest rectification efficiency possible, I-T-E engineers have:

(1) taken the most efficient method for converting ac to dc—by mechanical switching; and then

(2) designed *equipment* to provide the highest efficiency obtainable with this method.

The result: almost ideal rectification!

A compact unit, easy to install and operate, the I-T-E Mechanical Rectifier gives top efficiency over the low 50 to 400 v. range—and from 25% to 125% of rated load.

The Rectifier is being used to advantage on continuous heavy-current d-c applications—in chlorine manufacturing, metal refining, and on motor load. *Thirty-seven* installed units—more than 200,000 amperes of connected load—prove the point!

FROM COAST TO COAST— STRATEGICALLY LOCATED I-T-E SALES OFFICES STAND READY TO SERVE YOU:

Birmingham, Ala.
Boston, Mass.
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I-T-E CIRCUIT BREAKER CO.

19th and HAMILTON STS., PHILADELPHIA 30, PA.

Power Switching Equipment: R&IE Equipment Div., Greensburg, Pa.
Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto
Export Sales: Philips Export Corp., N. Y.

circuit breakers • switchgear • unit substations • isolated phase bus structures • mechanical rectifiers • electronic components • special products.

new bulletins

. . . catalogs from leading manufacturers

200—Separator Catalog

Instead of working out long equations and formulas you can, with the help of four-page bulletin 201, look at a graph and decide the size Hi-eF Purifier to meet your operating conditions. Specifications and applications of these line-type purifiers are also given. V. D. Anderson Co.

201—Dust Collectors

Dust collection is a two-part job: the dust and dirt must be stopped and a high rate of air flow must be maintained. This 15-page bulletin explains, by means of design drawings, graphs, and installation photographs, how Aeroturn collectors do both jobs. Turner & Haws Engineering Company, Inc.

202—Combustion Control

A packaged, metered control unit designed to keep pace with the development of the larger sizes of pressure fired water-tube factory-assembled boilers is described in four-page bulletin C-101. Included are other units necessary for automatic combustion control. Reliance Instrument Manufacturing Corp.

203—Deslaggers

Air and electric-drive wall deslaggers designed with the maintenance man in mind are described in four-page bulletin 1016. Sketches and cut-away views show the easy accessibility for inspection and maintenance and the simple steps needed to dismantle the units. Copes-Vulcan Div., Continental Foundry & Machine Co.

Pressure Equipment

One of the country's oldest manufacturers of equipment and accessories for plants, piping, steam, air, and gas under pressure, has published catalog 400, covering its line of separators, traps, and boiler trim. A condensation of the information in catalogs 500, 600, and 700, the booklet gives adequate size and pressure tables and technical data on the most frequently and commonly used equipment. **Please send requests directly to Wright-Austin Co., 3245 Wight St., Detroit 7, Mich., on your company letterhead.**

204—Firing Equipment

Over 50 years of leadership in the manufacture of industrial-commercial firing equipment is reflected in 19-page general catalog 3048. Schematic drawings, layouts of typical installations, cutaway views of burners and burner parts, and photographs of burners and installations are included among the many illustrations. Specifications and detailed data on exclusive features of this company's oil, gas, and combination oil-gas burners are given. Petro Division.

205—Cyclonic Combustion

Principles of the patented method of Cyclonic Combustion are explained in four-page folder, "All Your Questions Are Answered By Cyclotherm." Descriptive drawings show how air is introduced into the combustion chamber at extremely high speeds in a revolving spiral vortex, radiating heat to the fire tube through direct radiation and convection. Cyclotherm Division of United States Radiator Corp.

206—Three-Drum Boilers

A pioneer in the application of 2½ in. diameter tubes to three-drum boilers describes its Type "C" boiler in revised seven-page catalog SB-49. These high-pressure, high-duty units are shown by means of cut-aways. A table gives specifications. Erie City Iron Works.

207—Sprinkler System

How fire safety cuts yearly insurance costs is shown graphically in a 14-page brochure. It illustrates the "spray" type of automatic sprinkler with a fusible element of solid organic chemical. This is reported to be the most sensitive, accurate, and adaptable means ever developed to detect and stop fire automatically. Globe Automatic Sprinkler Co.

208—Flow Meters

Important data on the Diaflow Meter, for measuring air flow, gas flow, and the ratio between the two flows, are presented in eight-page booklet 52-1017-37. According to the booklet, the meter is particularly well suited for industrial furnaces and sewage disposal plants. The Hays Corporation.

209—Motor Controls

"The ABC of Large A-C Motor Controls," is a 36-page special issue of the "E-M Synchronizer," No. 39, presenting in an easily understood manner basic facts helpful in the proper selection and application of controls for large industrial motors. Illustrations and charts are explained and discussed in the accompanying text. The booklet also includes discussions of the latest developments in motor and personnel protective features. Electric Machinery Mfg. Co.

210—Motors

Three picture-story bulletins, GEA-6012, GEA-6013, and GEA-6027, contain complete descriptions of maintenance, performance, and protective features of Tri-Clad "55" motors. Each booklet includes a double-spread cutaway drawing of the motor. The three types discussed are the dripproof, inclosed, and gear motors. General Electric Co.

Wiring Systems

"Steel Electrical Raceways," presents nine chapters with 132 pages of down-to-earth factual text and clear illustrations telling how to solve the problems encountered in the design and installation of wiring systems using steel conduit raceways. It contains a reference guide to National Electrical Code requirements as they effect steel conduit, useful data tables with examples of their use, gives dimensions and types of conduit and fittings, shows tools and equipment needed for proper installation, and the "how-to" of conduit installation. **Please send requests directly to Rigid Steel Conduit and Electrical Metallic Tubing Section, National Electrical Mfrs. Assoc., 155 East 44th St., N.Y., on company letterhead.**

211—Dry-Type Transformers

"Operation and Maintenance of Dry Type Transformers," was written to guide maintenance personnel, management, and electricians in the proper installation and care of dry-type transformers. The simple trouble chart helps find trouble spots and points out the necessary remedies. Hevi-Duty Electric Company.

212—Battery Manual

Users of storage batteries for heavy-duty industrial uses will be interested in the sixth edition of the storage battery "Red Book." The 60-page handbook begins with a brief treatise on the theory of the lead-acid battery. Subsequent sections give detailed instructions on the care and operation of batteries, maintenance repairs of standard and special parts, and technical tables. Gould National Batteries, Inc.

213—Fractional hp Motors

Construction features of Form "F" fractional horsepower motors are discussed in four-page folder 1-5, Pl. Tables and drawings show ratings, frame sizes, and dimensions. Century Electric Company.

214—Flow Control

Bulletin 470, "Dynamic Flow Control," introduces the Model 59 valve-mounted controller for high speed flow control applications. It covers a typical flow control system, dividing it into its four components: the Model 59 controller; the set point transmitter; the measurement transmitter; and the Stabiliflo Control Valve. An explanation of the controller mechanism centers on the provisions for proportional, derivative, and reset control actions. Complete specifications and diagrams are included. The Foxboro Co.

215—Valve Chart

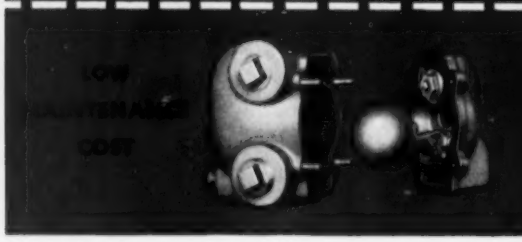
The front of a handy, desk-size flexible plastic chart showing the port and stop arrangements of Nordstrom multiport valves offers diagrammatical sketches of

NOTE—Each new bulletin item has a key number for your convenience in asking for a free, personal copy. Circle key numbers on Reply Card between pages 38/39 & 94/95.

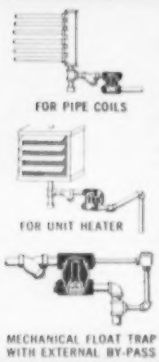
NEW HOFFMAN
FLOAT and
FLOAT and THERMOSTATIC
TRAPS

FEATURING:

1. Integral thermostatic air by-pass consisting of thermal element, seat, and cage—factory set and sealed.
2. Valve lever and seat assembly constructed of brass stampings. Spherical steel copper clad float.
3. Stainless steel valve pin and valve seat—valve pin adjustable for positive seating.
4. All working parts mounted on the cover for easy accessibility—no pipe connections to break.



Float and Thermostatic Traps with cover construction so designed that all working parts of the trap are readily accessible. Once installed there is no necessity for the breaking of any pipe connection as all cleaning and repairing can be made by removing the cover of the trap.



Again Hoffman provides industry with an improved product, refined to *function more effectively and economically in removing condensate.*

Hoffman engineers thus anticipate industrial steam heating trends that demand less maintenance and operating costs.

The new 50 Series Float and Thermostatic Trap has an integral thermostatic air by-pass consisting of thermal element, seat, and cage, factory set and sealed assuring dependable service and easy maintenance.

The same fine Hoffman quality and precision workmanship prevails in these traps as in the other Hoffman heating specialties. The valve lever and seat assembly is constructed of durable brass stampings. The spherical float is copper clad steel. The valve pin, adjustable for positive seating, and the valve seat are made of stainless steel. Sizes are available from ¾" to 2"—pressure requirements of ½ lb. to 125 lb.

If you are planning to install low, medium or high pressure Float or Float and Thermostatic Traps, it will pay you to ask for Hoffman's new illustrated catalog sheet, available upon request.

HOFFMAN SPECIALTY MFG. CORP., 1001 York Street, Indianapolis 7, Indiana
Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensate Pumps

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new bulletins

—Starts on page 39

four types of multiport valves. Each sketch has a revolving two-color plastic disc attached to the center to illustrate the fluid traffic control obtained in the various types of multiport valves. The back illustrates with smaller diagrammatical sketches the numerous other positions possible with different multiport arrangements. Rockwell Manufacturing Company.

216—Pilot Operated Valves

The new line of solenoid pilot-operated air control valves designed and manufactured by this company is described in seven-page booklet SK-53. Dimensional data and drawings are included for three-way, four-way, and four-way five-port application in pipe sizes ¼ through 1 in. Valvair Corporation.

217—Hand-Pushed Trolleys

Of special interest to companies requiring a mechanical method of handling products intermittently, where the cost of a power driven trolley conveyor would not be justified, is 16-page catalog 453. It contains complete information on hand-pushed trolleys, cranes, and switches. Jervis B. Webb Company.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 38/39 & 94/95. Your requests will be handled promptly.

218—Portable Hoists

Over 100 different types and sizes of portable hoists and a wide variety of utility maintenance tools are listed with illustrations and specifications in eight-page catalog CL. Among the types included are safety-pull ratchet level hoists, Quik-Lift electric hoists, all-purpose Hoist-Alls, and Mighty Midget Pullers. Coffing Hoist Company.

219—Slings

"Slings for Industry," four-page folder 5308 lists slings having approximate breaking strengths of 1000 lbs to 243.4 tons with safe loads shown in tons for various angles of use. Three body styles are explained, the Atlas 8-part round-braided body, the Drew 6-part flat-braided body, and the Monarch single-part body. Bulletin 5201, published by the same company, gives industrial standards for Safe-Lock wire rope assemblies. Macwhyte Company.

220—Materials Handling

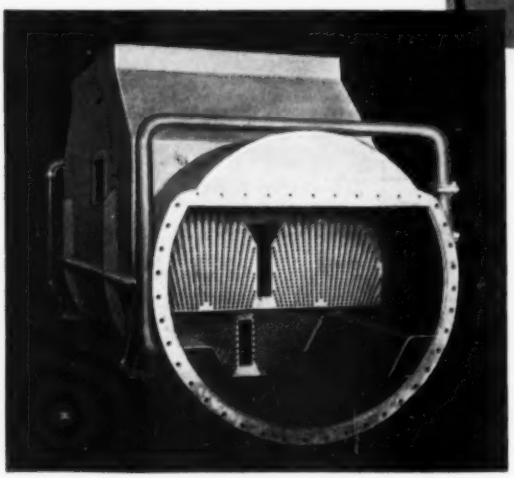
External house organ "The Conveyor," is published for the users of materials handling equipment. It contains installation photographs and drawings along with written text on conveying, transmission equipment, and ball bearings. Stephens-Adamson Mfg. Co.

221—Elevator Buckets

Cast malleable and Promal elevator buckets, for handling such diverse materials as coal, coke, ores, grain, cement, chemicals, pulp, clay, sugar, and salt, are described in 12-page booklet 2465. Fifty-five standard sizes are listed with

Elliott careful engineering builds better condensers

An Elliott 5000-sq. ft. divided water-box condenser installation. Condenser is equipped with Elliott twin two-stage air ejector. Elliott Crocker-Wheeler motors drive circulating water and condensate pumps.



This view of a 10,000-sq. ft. condenser with tube plate removed shows the fan type tube layout, partial tube supports, and air intake baffles.

THIRTY-FOUR YEARS of step-by-step development are back of the Elliott Type F Surface Condenser, and have resulted in a number of advances providing for better, more efficient operation. The most important of these results are:

1. *Maximum penetration of steam, with minimum pressure drop, due to improved tube layout.*
2. *Condensate temperature equal to steam temperature.*
3. *Minimum oxygen content of condensate.*
4. *Minimum terminal difference – the temperature difference between steam in the top of the condenser, and the discharge water.*

A further advantage in Elliott Type F condensers is the partial tube support design, in which support plates for the upper and lower tube banks are staggered rather than continuous, and thus do not divide the condenser chamber into cells, causing excessive pressure drop or dead spaces.

Type F condensers are built in sizes from 500 to 15,000 sq. ft., in both divided and undivided water-box type. They can be designed to meet specific space conditions. For details, contact your local Elliott engineer, or write Elliott Company, Jeannette, Pa.

ELLIOTT Company

CONDENSER DEPARTMENT

C3-1

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tools that Streamline electrical maintenance

FOR ELECTRONIC TROUBLE SHOOTING . . .

WESTON INDUSTRIAL CIRCUIT TESTER
(Model 785) the versatile 28 range super-sensitive portable tester.

Especially designed for checking electronic control and power equipment. Seven d-c voltage ranges: .1 to 1000 (20,000 ohms per volt) . . . six a-c voltage ranges: 5 to 750 (1000 ohms per volt) . . . six d-c current ranges: 50 microamperes to 10 amperes . . . four a-c current ranges: .5 to 10 amperes . . . five resistance ranges: 3000 ohms to 30 megohms . . . all ranges full scale . . . a-c and d-c current ranges extended with external transformer or shunts.

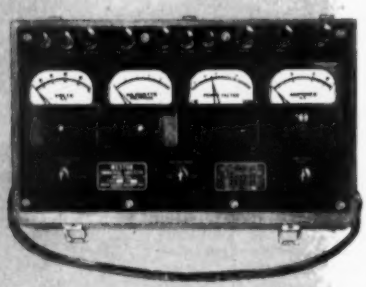
FOR MOTORIZED EQUIPMENT . . .

WESTON CLAMP VOLT-AMMETER
(Model 633) measures current and voltage without breaking circuits.

Combines in one instrument five full-scale a-c current ranges of 1000/250/-100/25/10 amperes with range overlap for good readability . . . three self-contained a-c voltage ranges of 700/350/-175 volts, with instrument insulated for 750 volt service. Has convenient 6-position thumb switch for range selection, and adjustable pointer stop for measuring motor starting current.

FOR POWER PROBLEMS . . .

WESTON A-C INDUSTRIAL ANALYZER
(Model 639) a combined Voltmeter, Wattmeter, Power Factor Meter, Ammeter . . . all interconnections made!



A real timesaver because only one hook-up is necessary to measure a-c current, voltage and power in single and polyphase circuits, as well as power factor in 3 phase, 3 wire, balanced circuits. Adequately insulated binding posts . . . high overload capacity. In compact oak case measuring only 18⅞" x 10⅞" x 6⅞".

AVAILABLE THROUGH LEADING DISTRIBUTORS

WESTON Instruments

WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J. 4815

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new bulletins

—Starts on page 39

dimensions, weights, and capacities. Detailed information is provided on the mounting of buckets on belts and chains, with tables and diagrams on bucket punching. Various chain attachments and elevator bolts are shown. Link-Belt Co.

222—Split Roller Bearings

Engineers and designers facing difficult bearing location problems will welcome this 16-page catalog which explains the use of an anti-friction roller bearing which is assembled around the shaft. Detailed drawings of various models and tables of specifications are included. The Cooper Split Roller Bearings Corp.

223—Drain Pipe

The faster it rains, the faster it drains, is the description of Poroswall pipe given in a four-page folder. A table lists standard dimensions and strength requirements. Fittings are illustrated along with a cross-sectional drawing of a typical installation. Poroswall Pipe Division, Walker Cement Products Co.

224—Swivel Joints

Operating engineers for plant and field installations, and design engineers will be particularly interested in 12-page bulletin 265-A, "Self-Aligning Swivel Joints for Piping." It contains complete specifications, dimensions, and application data for this company's entire line of flexible ball, swing, swivel, revolving, and other types of movable joints. Barco Manufacturing Co.

225—Pipeline Expansion

Catalog 135, 24 pages, is packed with engineering applications and selection data necessary to the proper solution of pipeline expansion problems. The center spread is devoted to a schematic piping layout illustrating various expansion joint applications and principles. Flexonics Corp.

226—Screw Pumps

Bulletin S-205, 12-pages, is devoted to standard gear-in-head, high-pressure long-body gear-in-head, and standard vertical gear-in-head screw pumps. Basic construction and design are discussed in detail and there are sectional views with indicated features; also external and installation illustrations, dimensions, and specifications. Bulletin S-206 includes comparable information as applied to double external bearing and hopper types. Warren Steam Pump Company, Inc.

227—Centrifugal Pumps

Thrustfre two, three, and four-stage pumps for heads up to 650 psi and with capacities of from 50 to 850 gpm are described in seven-page bulletin 237-C. Detailed cross-sections are presented for each type along with specifications. Pennsylvania Pump and Compressor Co.

228—Code Changes

Printed on heavy cardboard, a chart showing the new, 1953 changes in the wire, cable, and conduit sections of the National Electric Code has been designed to be hung on the wall for ready reference. It includes all approved wire and cable insulations and short paragraphs explaining other code changes. Triangle Conduit & Cable Co., Inc.

Continued on page 98

STANDARD HD
TRADE MARK
OIL

21,000 hours young!

● This 1320-hp diesel engine has provided many hours of economical service for the City of Benson, Minnesota, Water and Light Department since it was installed in October, 1948. It has been operated on an average of 20 hours each day and has generated over 13 million KW at an average load factor of 75%.

In this hard-working diesel, the lubricating performance of STANDARD HD Oil has been outstanding, particularly in view of the fact that crude oil has been used as fuel. Visual evidence of the clean, protective lubrication provided by STANDARD HD is presented in the above unretouched photograph of a piston removed from the diesel after 21,000 hours' operation. Deposits are at a minimum; rings are free. The original fill of STANDARD HD has not been changed, yet a recent examination and analysis of the oil showed it to be in excellent condition.

Diesel operators throughout the Midwest are receiving service like this from STANDARD HD Oil. The Standard Oil lubrication specialist serving in your section of the Midwest will be glad to give you information about the use of STANDARD HD in plants near your own. Just phone your local Standard Oil office. Or, write: Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY STANDARD *(Indiana)*

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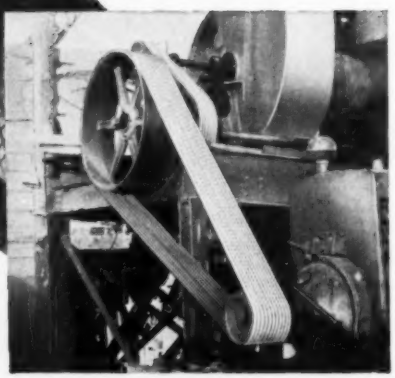
Notice the CONCAVE SIDES of the Gates V-Belt-

(U.S. PATENT NO. 1813698)

. . . that's why Gates V-Belts Last Longer!

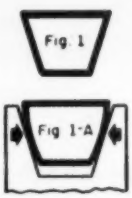


Typical Gates Vulco Rope Drive—the Gates V-Belts are built with Concave Sides to insure longer belt wear.

Look at this!

In *half a minute* you can prove for yourself the belt-saving advantage of the CONCAVE SIDES.

Take any *straight-sided* V-Belt (Fig. 1) and bend it as it bends in going around its pulley. At the same time, grip its sides with your fingers and *feel* those sides *bulge out* as in Fig. 1-A.

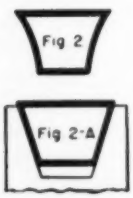


Clearly, those bulging sides will press *unevenly* against the V-pulley—and this causes extra wear at the points shown by the arrows (Fig 1-A).

Now bend a Gates Vulco Rope with CONCAVE SIDES (Fig. 2)

As the belt bends, grip its sides—and you will feel the precisely engineered CONCAVE SIDES *fill out* to an *exact fit* in the sheave groove (Fig. 2-A).

These sides press *evenly* against the V-pulley. All wear is distributed *uniformly* across the full width of the Gates Vulco Rope—and this means *longer* belt life and *lower* belt costs for you!



When you buy V-Belts, be sure to get the V-Belt with the CONCAVE SIDES— The Gates Vulco Rope.

Gates Engineering Offices and Jobber Stocks are located in all industrial centers of the United States and in 71 foreign countries.

CS-537

V-Belts — Hose Molded Rubber Goods for industry *World's Largest Maker of V-Belts*

Gates® VULCO ROPE DRIVES

THE GATES RUBBER COMPANY • DENVER, U.S.A.

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STEAM COST REDUCED

At Chemical Plant with Detroit RotoGrate Stoker!

Write for this coal saving reprint. No obligation.

Handling High Peaks at Low Cost in Coal Fired Virginia Plant

American Cyanamid Company
Calco Chemical Division—Piney River, Virginia

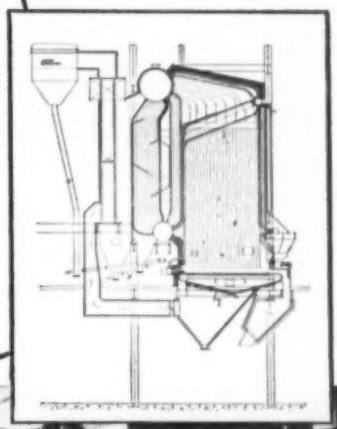
By C. A. Reed, Director of Engineering, National Coal Association
Photographs by Clifford H. Adams, Staff Photographer, Bituminous Coal Institute

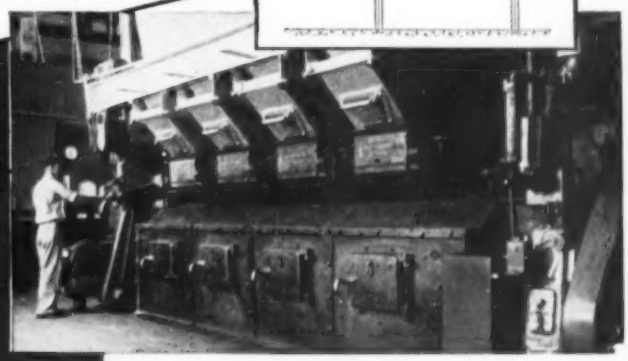
Operating record of this Virginia plant confirms design estimate of 85 per cent efficiency. Steam costs were lowered to 65 cents per thousand, including depreciation, operation, and maintenance.

REPRINTED FROM SOUTHERN POWER & INDUSTRY

Compliments of DETROIT STOKER COMPANY, Detroit, Michigan

Sudden load surges from 50,000 to 90,000 pounds of steam per hour easily handled. Detroit RotoGrate with Riley two drum steam generator. Air preheated to 310° to 345° F.





DETROIT SINCE 1898 STOKERS

DETROIT STOKER COMPANY

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NO Reducing Valve Needed

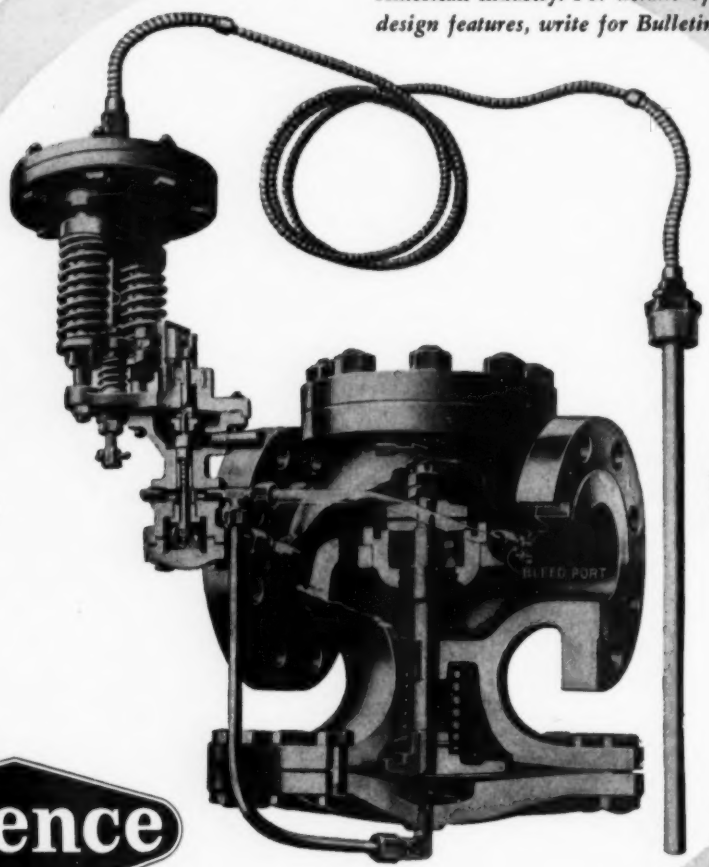
Here's real economy in temperature control.

Because Spence Temperature Regulators are designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated.

The Spence Regulator takes steam directly from the boiler or high pressure line, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater.

This means one relatively small combination pressure and temperature regulator replaces a reducing valve of the same size and a larger temperature regulator. Practically the entire cost of the large separate temperature regulator is saved. And, the total saving would also include the cost of a 3-valve by-pass along with all labor for installation.

This design feature is just one of the reasons for the thousands of Spence installations throughout American industry. *For details of other important design features, write for Bulletin T50.*



SPENCE
TYPE ET150
Temperature
Regulator

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

SS-131

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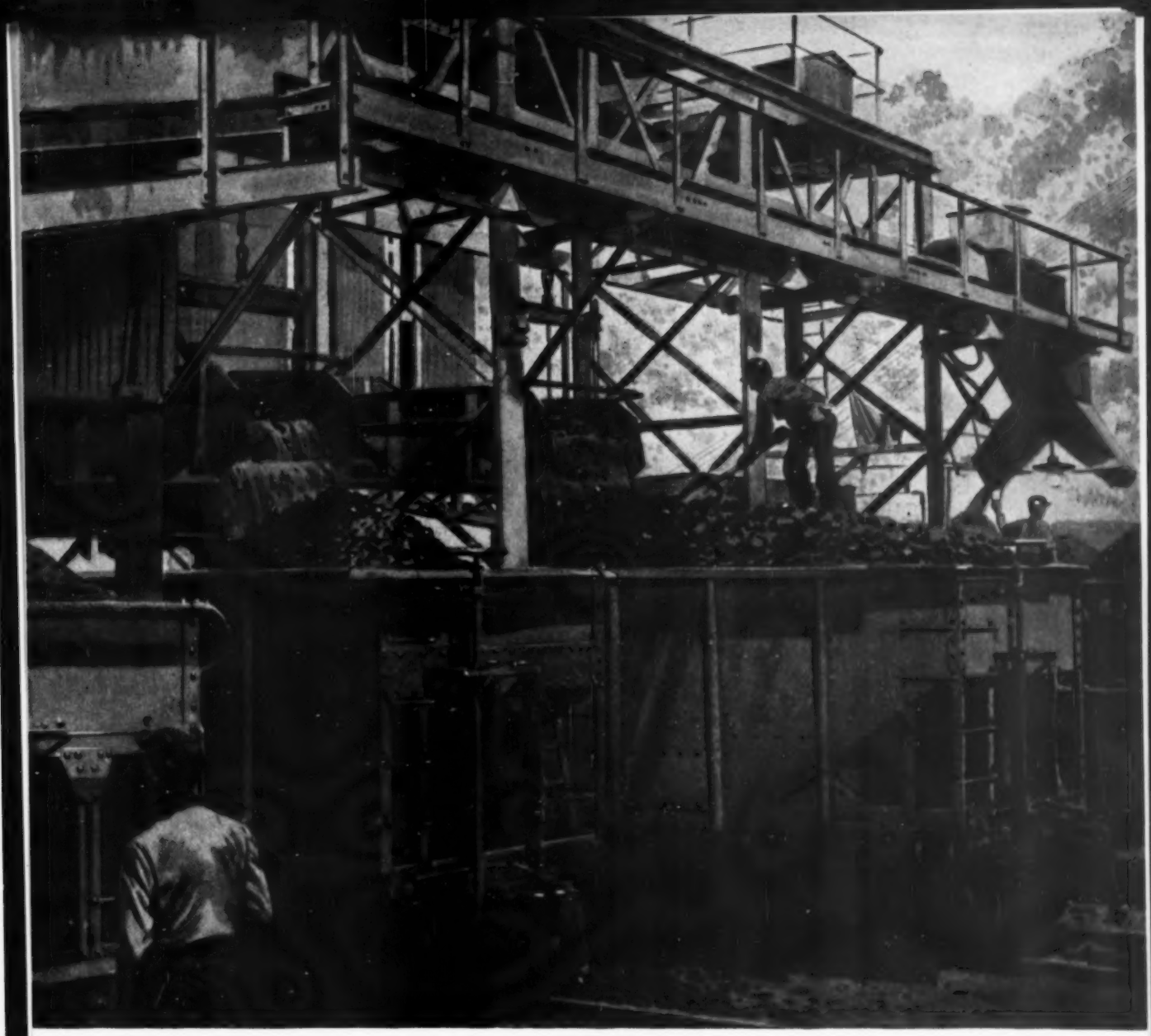

BOOM LOADING "GENTLES" THE COAL INTO WAITING CARS . . .
MAINTAINS INITIAL SIZING AND BANS DEGRADATION

BEACON COAL

EASTERN GAS AND FUEL ASSOCIATES

PITTSBURGH • BOSTON • CHICAGO • CLEVELAND • DETROIT • NEW YORK
NORFOLK • PHILADELPHIA • SYRACUSE

For New England: New England Coal & Coke Co., For Export: Castner, Curran & Bullitt Inc.

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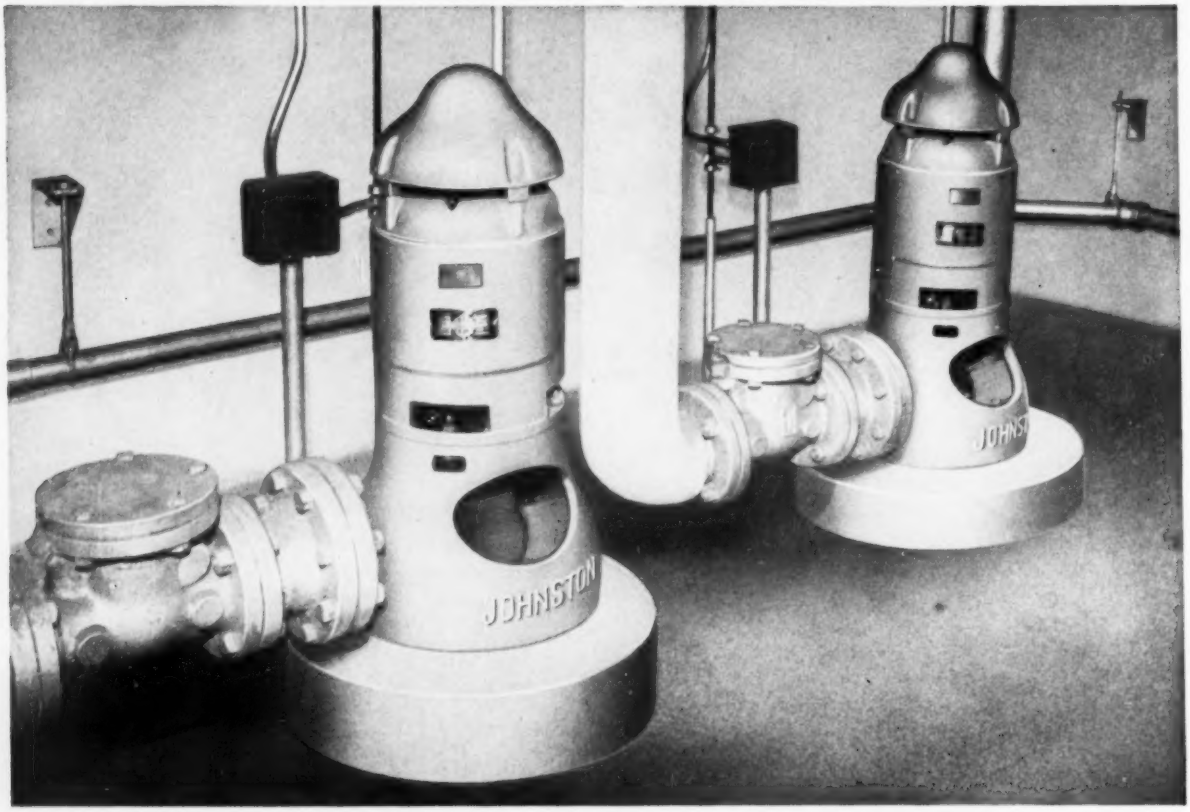
In All Kinds of Industrial Pumping Applications



JOHNSTON PUMPS ARE DOING A BETTER JOB...

Take this hot well installation, for example. Two Johnston Unit-Line, 3 horsepower, close-coupled pumps delivering 120 gallons per minute against a 65 foot head, were selected for this job, because . . .

1. **NO PACKING GLAND MAINTENANCE**
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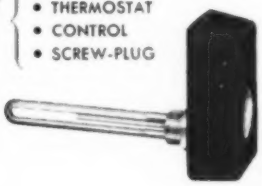

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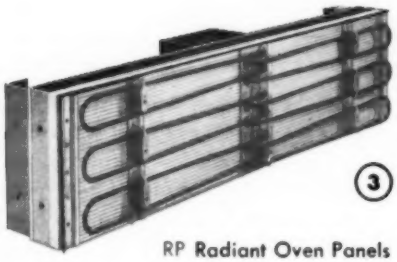

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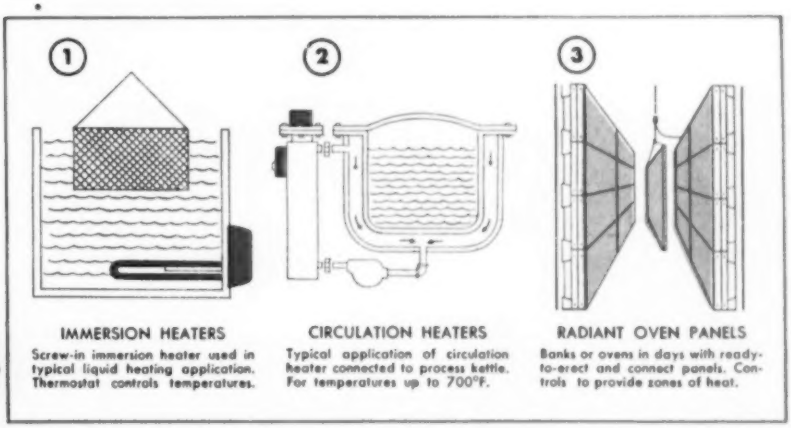
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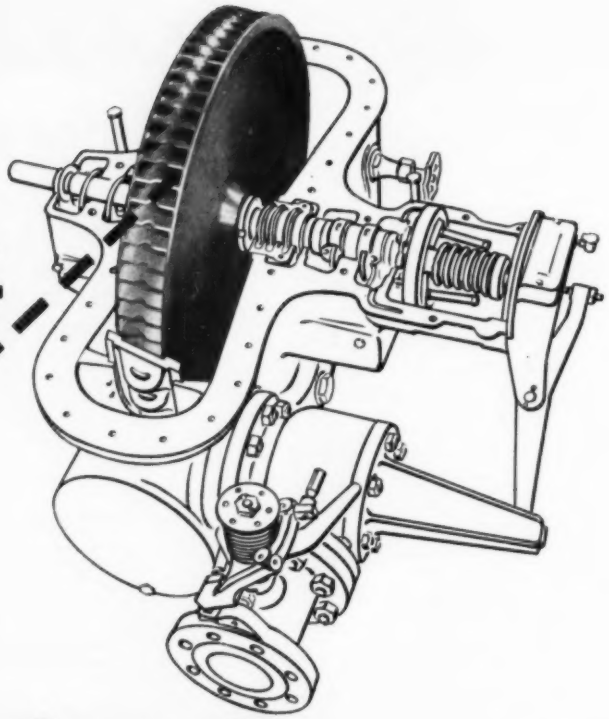
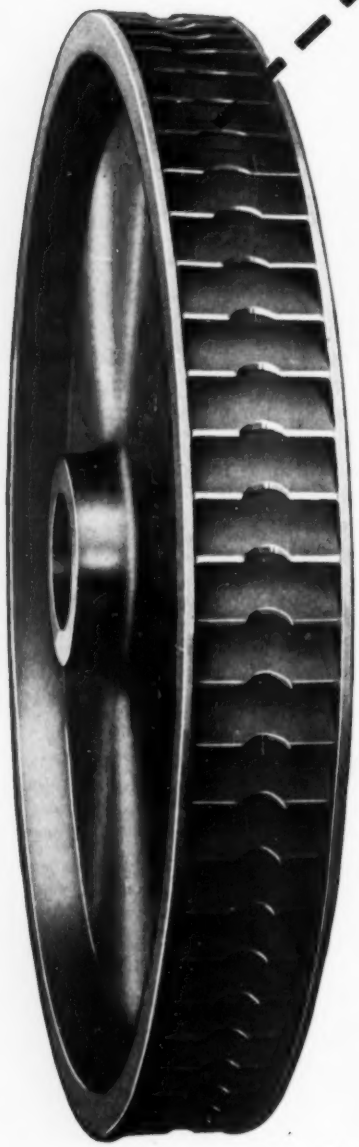
TERRY SOLID WHEEL





..."trade mark" of a trouble-free turbine

This is the rotor of a Terry solid-wheel turbine. There are a number of reasons why it has become a symbol for reliable, trouble-free operation.

First, because the wheel is a single forging, in which a series of semi-circular buckets is milled, there are no separate parts to become loose or work out.

Second, because the power-producing action of the steam takes place on the curved surfaces at the back of the buckets, blade wear is of little consequence. Wear does not materially affect horsepower or efficiency.

Third, because the steam enters the buckets in a direction at right angles to the shaft, there is no need for close axial blade clearances. The blades cannot foul. There is a one inch clearance on either side of the wheel. In addition, the blades are double rim protected.

These are only a few of the reasons why the Terry solid wheel has become a "Trade Mark" for trouble-free turbine performance. For complete details, send for a copy of bulletin S-116. No cost or obligation.

THE TERRY STEAM TURBINE CO.
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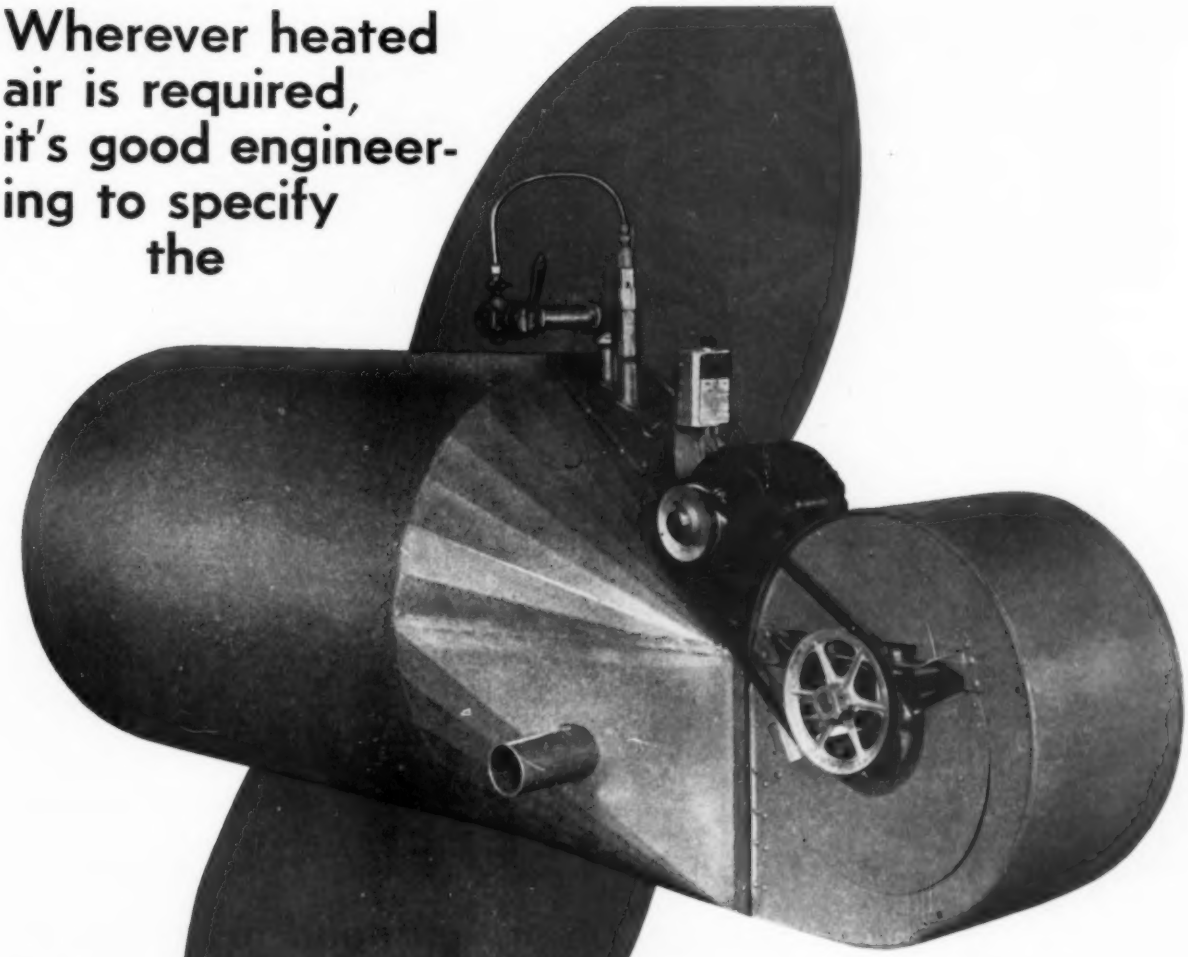
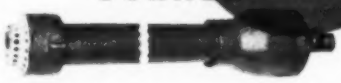
Wherever heated air is required, it's good engineering to specify the



John Zink Direct Fired Air Heater

Between - the - Tube BURNER



It is not necessary to form the tubes around the burner to secure maximum heating efficiency. Flame contact is equalized along all heating surfaces.

Furnished in groups of heads. Fires directly over stoker.

Recommended for the drying of lumber, ceramics, hardwood flooring and paint on toys; or dehydrating food products, feed, fertilizers, hay or tobacco.

The John Zink Gas-Fired Air Heater is a complete unit ready for installation. Each unit is built to customer's specifications as to size and capacity.

The John Zink Air Heater will burn any natural, mixed, manufactured or LP gas.

Let John Zink and his engineers solve your commercial or industrial heated air requirements.

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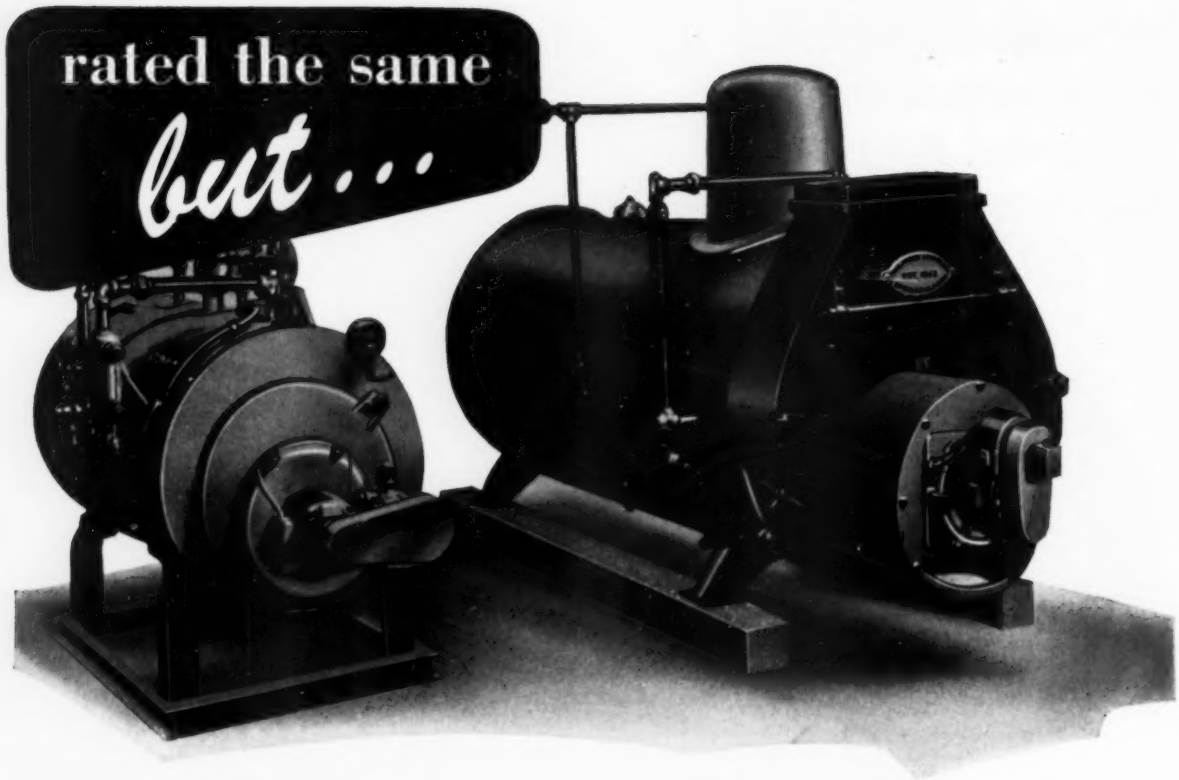

only the bigger, stronger LEFFEL can deliver when you need extra steam

Look at these figures

	LEFFEL BOILER	A "PACKAGE-TYPE" BOILER
Rating	20 HP	20 HP
Length	9'	6' ±
Height	6'8"	4'6" ±
Heating Surface	181 sq. ft.	54 sq. ft. ±
Shipping Weight	6500 lbs.	2500 lbs. ±
ACTUAL MAXIMUM CAPACITY	40 HP 1380# per hr.	20 HP 690# per hr. ±

It will pay you — in the long run — to compare carefully and buy wisely.

The Leffel boiler is rated at 20 H.P.; so is the little "package-type" steam boiler. All similarity ends with that claimed rating.

The package boiler may deliver 20 H.P. — but no more. The Leffel boiler can be operated day after day at *50 percent above its rating;* in an emergency it can deliver up to 40 H.P. with safety.

Claims can't help you get steam from a boiler which is prone to break down under the strain of continuous operation — which just can't deliver beyond its rating.

There's no corner-cutting in the construction of a Leffel boiler. It's built to take it. Performance proves that Leffel's extra-rugged construction means greater dependability and longer life, plus the ability to carry a 100% overload in an emergency.

One look should tell you that the bigger, obviously stronger Leffel boiler will be a more reliable source for the steam you need. And you will find that despite their greater strength and greater capacity, Leffel boilers are competitively priced.

If you're looking for a completely dependable source for low-cost steam, trouble-free service and simple operation, you'll want to know more about Leffel boilers. They are built in a complete range of sizes from the smallest to the largest Scotch types, for oil, gas or coal firing. Bulletin 236 has all the details; send for your copy today.

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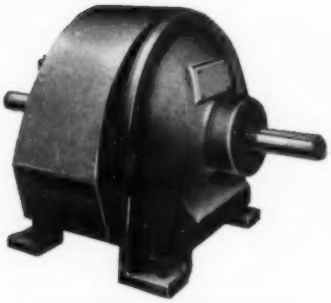
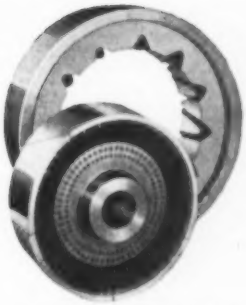
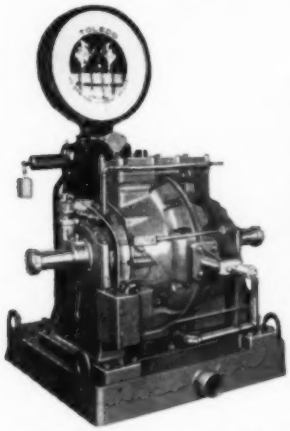


AIR COOLED COUPLINGS

AJUSTO-SPEDE MOTORS



AIR COOLED BRAKES



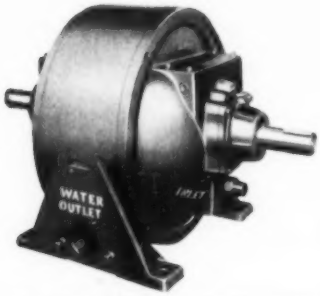
ABSORPTION DYNAMOMETERS

EATON

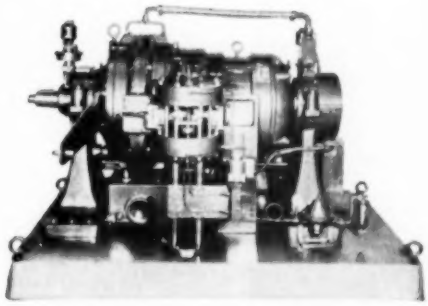
DYNAMATIC

EDDY-CURRENT ROTATING EQUIPMENT

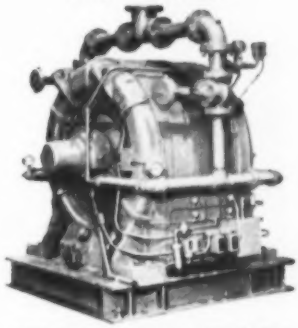
PRESS DRIVES



LIQUID COOLED COUPLINGS



UNIVERSAL DYNAMOMETERS



LIQUID COOLED BRAKES

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Subsidiary of **EATON MANUFACTURING COMPANY,** Cleveland, Ohio

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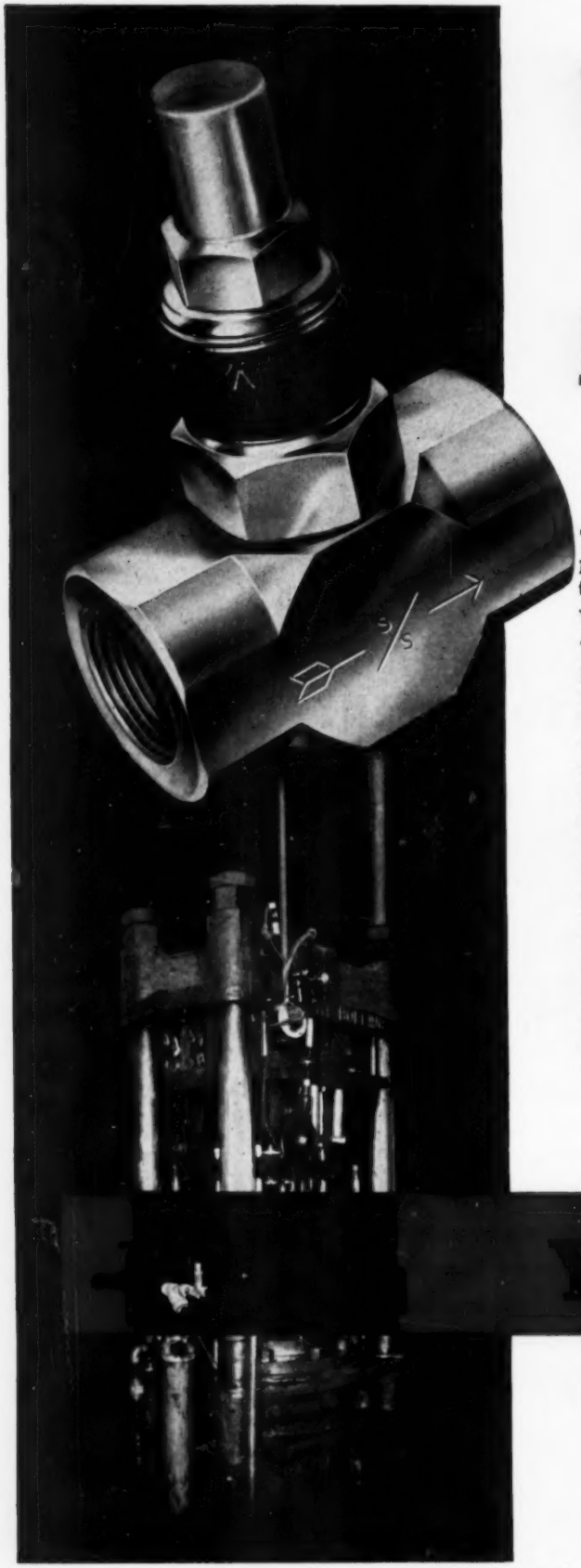

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the steam trap designed with more production in mind

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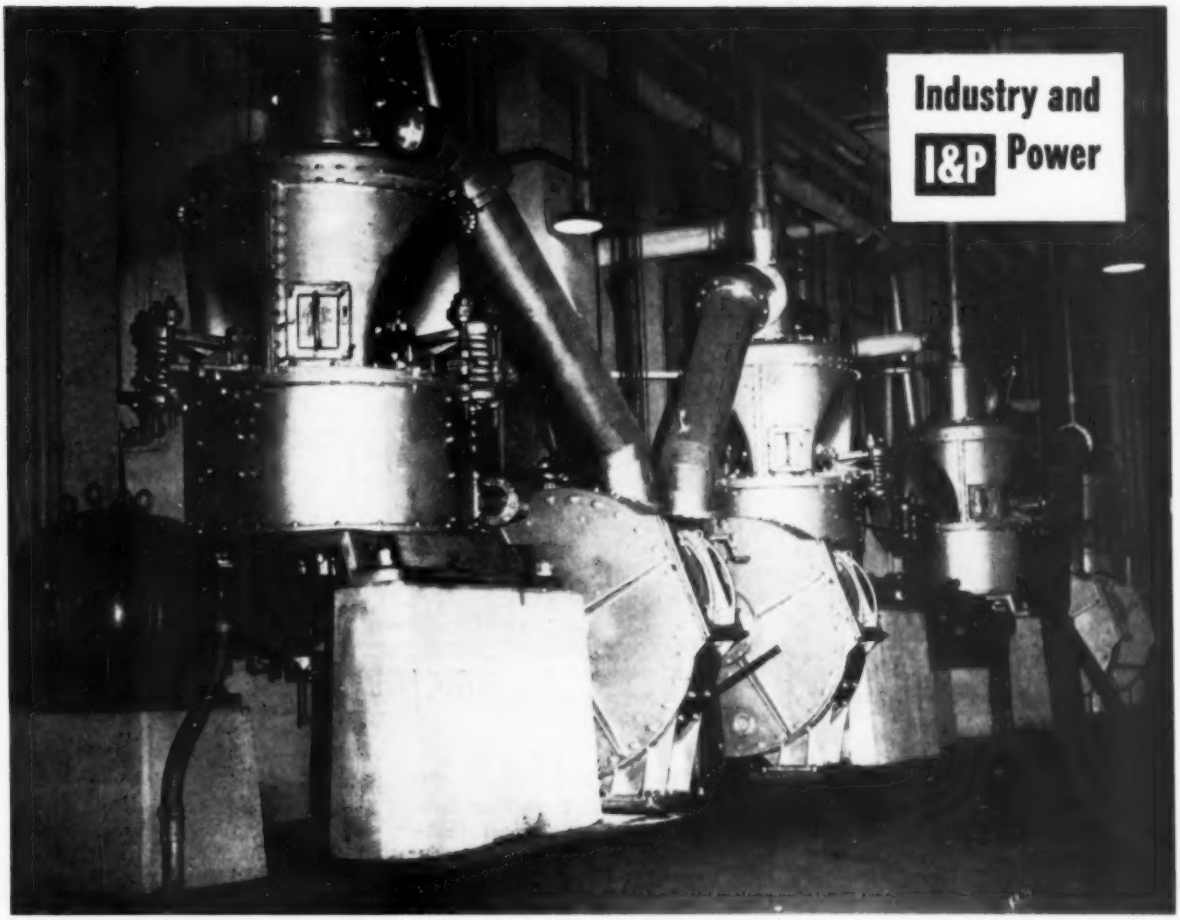


Four bowl type coal pulverizers, two for each steam generator, supply fuel to burners mounted in the front furnace walls.

New 20,000 kw Steele Street Plant Extension Provides

More Power For Jamestown

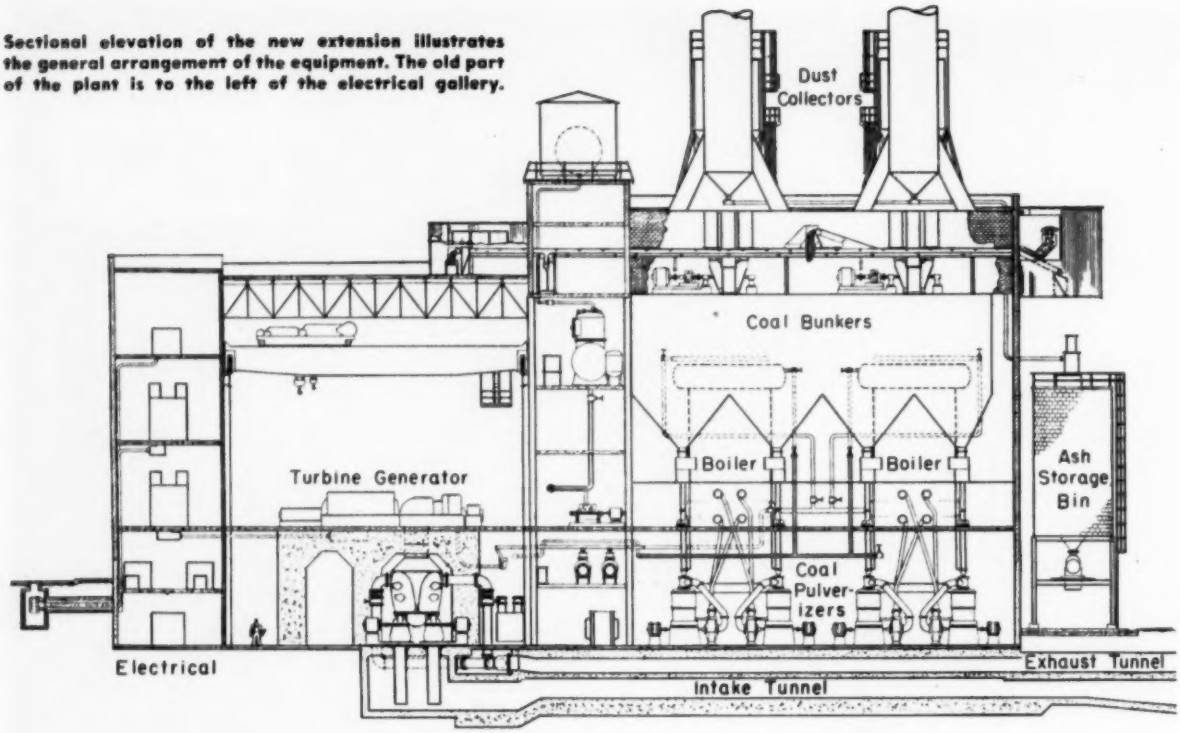
WALTER RUDOLPH

SEVERAL YEARS AGO the city-owned power plant at Jamestown, New York again experienced growing pains. This station, known as the Steele Street Plant, is one of the oldest and one of the most successful municipal power plants in the country. Since its creation in the 1890's by a special taxpayer's election, the system has enjoyed steady growth. The latest increase in power demands which necessitated the extension of existing facilities indicates even higher system power loads can be expected in the future.

Cooling Water Problem

The plant is located on the Chadakoin River, which originates at the outlet of Lake Chautauqua. This stream furnishes the cooling water for the condensers although in dry weather the flow is very small. Since the volume was hardly enough for the then existing station load, the problem of obtaining cooling water for the new power plant expansion was evident. A search for a better plant site was unsuccessful because poor load bearing soil characteristics, even worse water supply, and/or unsuitable coal delivery produced stalemates at all potential alternate locations. Finally, it was decided to condemn sufficient land at the old site for the installation of a cooling

Sectional elevation of the new extension illustrates the general arrangement of the equipment. The old part of the plant is to the left of the electrical gallery.



tower, which would dissipate the heat absorbed in the condensers and would permit recirculation of the available river water.

Building Construction

With the site established, particular study was focused on designing an ultra-modern power plant. The building is footed on concrete spread foundations, and has a steel superstructure with red brick exterior. Profuse use of glass block in the outside walls and careful selection of the colors for the interior painting combine to provide bright but restful working areas. Well arranged wash rooms, locker rooms, and a lunch room add to personnel convenience and comfort. The building also contains space for two additional boilers and a turbine-generator with auxiliary equipment.

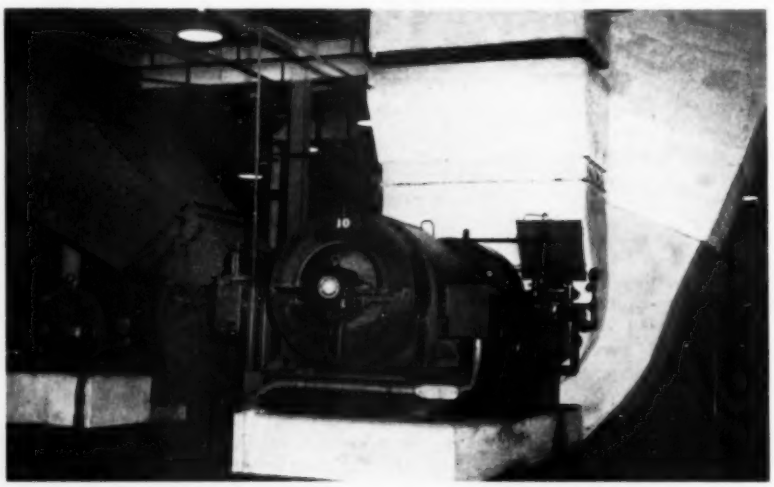
Steam Generators

Two, bent tube, natural circulation, two drum steam generators with water cooled furnaces and pendent type interbank superheaters are installed. Each of these units has a continuous duty steam rating of 150,000 lb per hr at 900-psig pressure and 900-F total temperature. At present, pulverized coal firing is employed, but the boilers are arranged for future conversion to oil or dual firing if necessary. Firing equipment includes four, bowl type coal pulverizers (two per boiler) each of which could operate both boilers at 60 percent capacity, and eight burners, four in the front furnace wall of each steam generator. In addition, both boilers are equipped with air heaters.

Dust Collection

Since the plant is located near the center of the city, prevention of air pollution was a prime design requisite. Combination mechanical-electrical fly ash collectors were selected and installed between the air heater outlets and the induced draft fan inlets. These units are designed to have an efficiency of not less than 92 percent at normal full boiler load. Collected dust passes to the plant's ash removal system.

When selecting the mechanical draft fans, the engineers followed



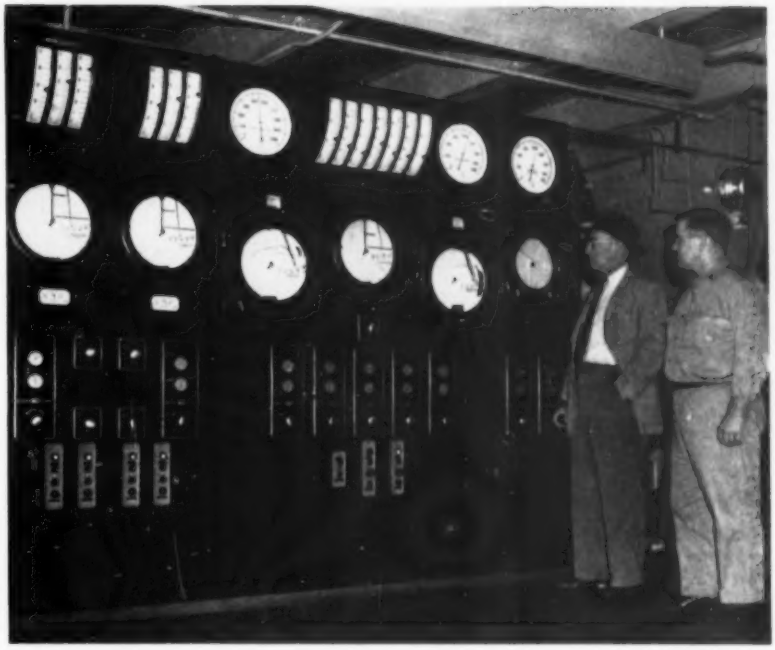
Hydraulic couplings provide ID fan speed control. FD fans have inlet vanes.

the unitary principle by employing one forced draft fan and one induced draft fan for each boiler. All fans have motor drives, the forced draft fans operating at constant speed and utilizing inlet vanes for regulation of the combustion air volume, while the induced draft fans are equipped with hydraulic couplings for variable speed control. Gaseous product volumes are discharged through two steel stacks, one for each boiler, that are the same height as the brick stacks of the old plant. These steel stacks have gunite linings to forestall corrosion. They are arranged so that one more boiler can be connected to each stack when future additions are made.

Feedwater System

A regenerative type system is installed to preheat the boiler feedwater. This system includes four closed stage heaters and one open deaerating heater. The necessary makeup water, which is obtained from the river, passes through a two stage evaporator before entering this feed cycle. Preliminary treatment is not necessary because of the low river water hardness, but internal treatment is utilized.

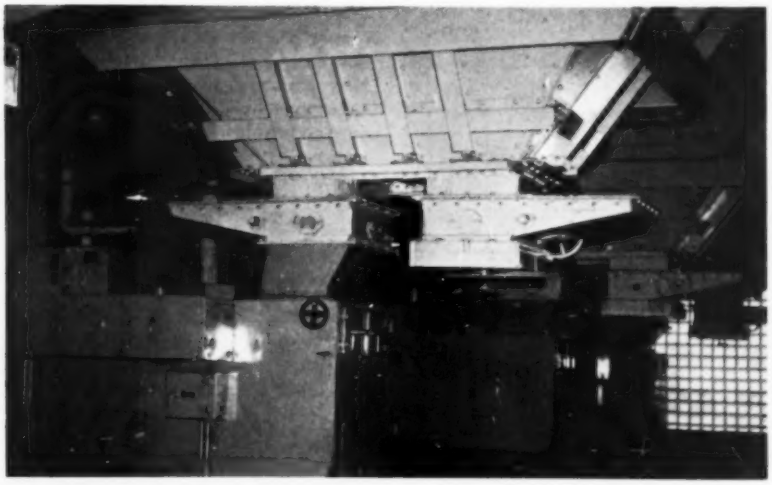
Since the turbine-generators in the old section of the plant operate at 275-psig pressure, any steam supplied by the new boilers for these units must pass through a reducing valve and desuperheating station. With this arrangement, it is necessary to include provisions for returning the proper amount of condensate to the high pressure plant because the old section does not utilize evaporated makeup. Pumps, controls, and special metering equipment are provided so that the quantity of condensate returned to the new plant approximately equals the steam delivered to the old section by the high pressure boilers. This eliminates the necessity of evaporating additional makeup in the high pressure plant.



Utilities superintendent C. Johnson, left, and W. Saxton check boiler controls.

Coal Handling

Coal handling is exemplary. Western Pennsylvania bituminous coal is unloaded over a track hopper, discharged through a feeder to a crusher, and elevated to the unloading tower. From this point, the coal is carried by a conveyor to the transfer tower which routes it either to the outside ground storage area or to the new section of the power plant. Coal passing to ground storage is moved with a bulldozer, which also feeds the tower conveyors when reclaiming coal from the pile. Inside the plant, cross conveyors connect the new bunker with both the new and old section boilers. The primary coal handling system is designed to move 100 tons per hr, while the elevator serving the reclaiming hopper has a capacity of 60 tons per hr.



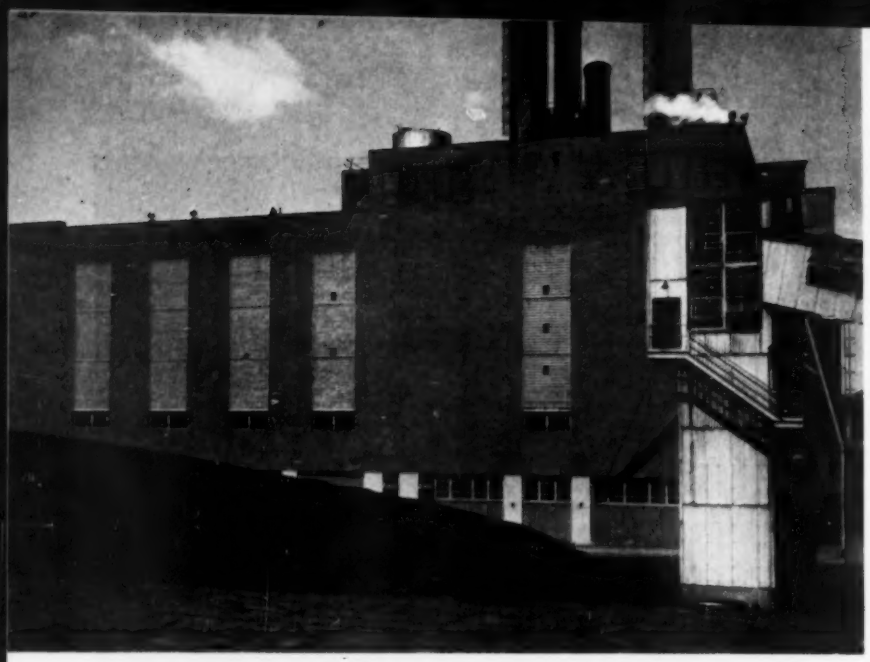
Automatic coal scales furnish a continuous record of the fuel consumption.

Ash Handling

Vacuum powered equipment is used for ash removal. This system has connections to the hoppers of the fly ash collectors, the back passes of the boilers, and the bottom of the furnace hoppers. The ashes are discharged to an elevated outdoor silo, which is equipped with an ash conditioner to minimize dust when loading trucks.

Turbine-Generator

The latest turbine is a 3600-rpm, 20,000-kw condensing unit with four steam extraction points for the stage feedwater heating system. Initial steam conditions are 850-psig pressure and 900-F total temperature. This turbine drives a hydrogen cool-



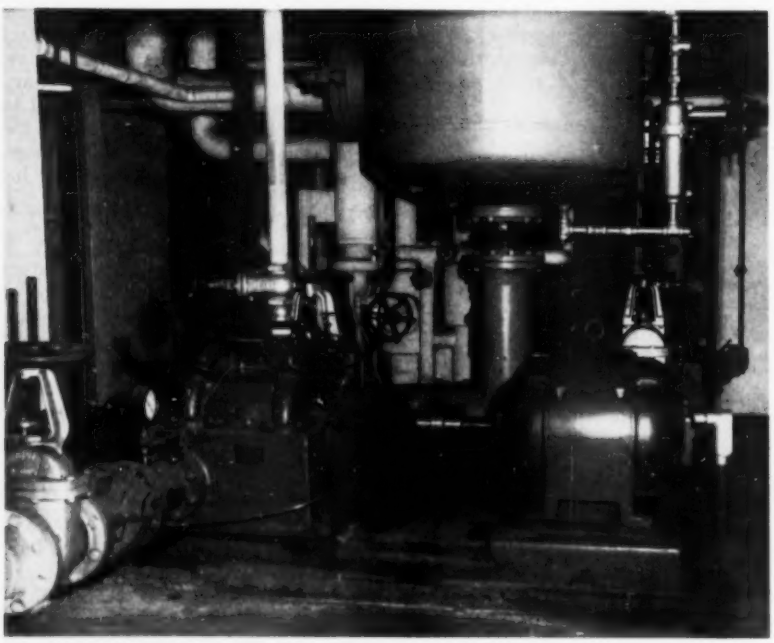
Exterior photo shows part of the coal handling system and the storage area.

ed generator with direct connected exciter. The generator has a rating of 25,000 kva at 0.8 power factor and produces 13,000 volt, 3 phase, 60 cycle current.

Condenser and Auxiliaries

Steam from the turbine is exhausted to a 20,000-sq ft, two pass, spring mounted, surface condenser with Admiralty metal tubes. Condenser auxiliaries include steam jet air ejectors; two condensate pumps, one motor driven and one steam turbine driven; and two circulating water pumps. The necessary cooling water from the Chadakoin River passes through two 84-in. wide traveling screens in the intake house, which has space for the installation of two more screens when expansion necessitates. Adjoining the screen house is a small chlorine feeding building, for treating the water.

Concrete pipes, large enough for future needs, carry water to the condenser and back to the open conduit at the cooling tower pump house. The tower is over a pool in the river. At times of low river flow, water returning from the condensers is picked up by the pumps and circulated over the cooling tower. Then it falls into the river above a spillway and finds its way back to the screen house intake.



Two condensate pumps serve the new, 20,000 sq ft, two pass surface condenser.

Switchgear

Electrical switchgear also looks ahead. High interrupting capacity, steel enclosed, isolated phase switchgear is used for main power connections at 13,800 volts. The circuit breakers have a short circuit interrupting rating of 1,000,000 kva, permitting addition of new generating capacity with minimum changes in plant connections or switchgear. Galleries have space for future sections of bus which may be required in years to come.

Power is distributed from the plant principally at generator voltage. It travels by underground and aerial cables to numerous substations in the city. In addition, 2300 volt service is available from a power plant substation. This feeder, and also the auxiliary power system, use air blast circuit breakers. The switchgear is installed in fireproof galleries directly above the central control room at four separate levels in the new section of this plant.

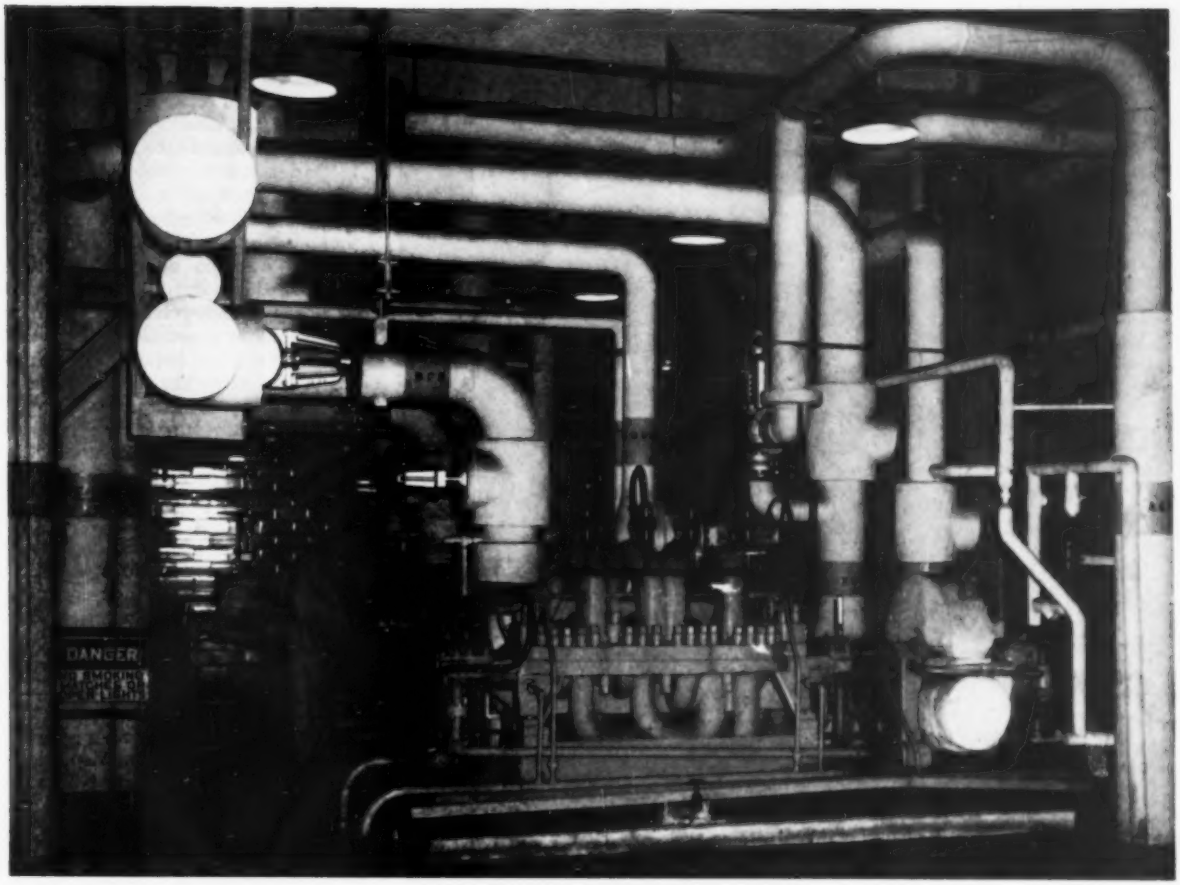
Load Distribution

Electrical load is divided between the buses of the old plant and the new. The new distribution bus is more flexible because it receives power supply from both the new generator bus and the old plant bus. In the future, this latter connection will be replaced by a bus from a second new generator. Furthermore, construction work eliminated much of the lower interrupting capacity switchgear in the old plant because half of the existing feeder cables were reconnected to the new generator bus.

All controls for present and future turbine generators, the 2300-volt substation, main power switchgear, the auxiliary power bus and substations, and remote supervisory control for two outlying substations are in the centrally located control room. This was accomplished in spite of the effective isolation of the new plant from the old.

System Performance

Evidence of the outstanding success achieved by the Jamestown power system is apparent from the



The feedwater system includes three boiler feed pumps, four closed stage heaters, one deaerating heater, and an evaporator.

fact that all assets have grown from the original $30,000 bond issue when the plant was first erected. Operating profits have paid for all subsequent expansions. In 1935, the system began a program of contributing to general city funds in lieu of taxes and by 1952, had turned over $2,526,000 in this manner. There is no tax on the city for its operation. Furthermore, between 1939 and 1946, $1,017, 500 in dividends were paid to consumers from system profits.

Construction details in late years have been handled by the J. G. White Engineering Corp., with G. G. Hollins, Chief Mechanical Engineer acting as principal consultant. C. O. Johnson is the Jamestown superintendent of public utilities (electric and water).

PRINCIPAL EQUIPMENT

Steam generators	Combustion Engineering, Inc.	High voltage cable	General Cable Corp.
Dust collectors	Western Precipitation Corp.	High voltage cable	General Electric Supply Co.
Coal handling equipment	Jervis B. Webb Co.	Combustion control	Republic Flow Meters Co.
Ash handling equipment	Beaumont Birch Co., Inc.	General service elevator	Otis Elevator Co.
Boiler feed pumps	Byron Jackson Co.	Foundations & building masonry	L. H. Ludwig & Co. Inc.
Feedwater heaters & evaporator	American Locomotive Co.	Structural steel	Bethlehem Steel Co.
Deaerating heater & accessories	The Swartwout Co.	Structural steel painting	Steel Painting Co.
Centrifugal pumps & air compressors	Ingersoll-Rand Co.	Piping	B. F. Shaw Co.
Turbine-generator	General Electric Co.	Steel stacks & breeching	Hammond Iron Works
Condenser	Foster Wheeler Corp.	Stack & bunker lining	Gunite Construction Corp.
Cooling tower & auxiliary pumps	Foster Wheeler Corp.	Insulation	Laco Applicators, Inc.
Turbine room crane	Whiting Corp.	Bulldozer	Freeborn Equipment Co., Inc.
Switchgear & current limiting reactors	General Electric Co.	Heating, ventilating & electrical work	Sans Corp.
Auxiliary substation & transformers	Westinghouse Electric Corp.	Plumbing & drainage	Sans Corp.
Neutral grounding resistor	Westinghouse Electric Corp.	Interior finishing	L. H. Ludwig & Co., Inc.
Battery charging equipment	Electric Products Co.	Painting & decorating	Thomas Steel Painting Co.

A TV camera, monitor, and receiver aid the operator in spotting potential trouble by watching the progress of steel strip in U. S. Steel's Gary Mill.

TV for Industry

Overlooking a freight yard or inside a steel furnace, a TV camera can give the operator a "bird's eye" view of what's going on in the plant. A proven product with a reasonable price tag, industrial TV, like its commercial big brother, is here to stay.

NORMAN J. RIVKEES and RICHARD T. KOHLER
Industrial Products Section
Radio Corporation of America

INDUSTRIAL television (ITV) has genuinely come of age. Until just a few years ago, most TV manufacturers shared a general reluctance to develop closed-circuit television equipment commercially for industrial uses before first gaining field experience in its application. Industrial plants, themselves the prospective ITV markets, were equally dubious about the extent and practicability of industry's use of closed-circuit television.

Now, it is generally agreed that commercial ITV equipment which meets the following specifications is acceptable by industry.

(a) *Stability*—the equipment design must assure continuous, 24-hour-a-day operation, with minimum service and maintenance requirements or shut-downs.

(b) *Simplicity*—because of the wide range of applications, simplicity of operation for non-technical personnel becomes a must.

(c) *Cost*—evaluating the practicability of most applications reveals that economic justifications for ITV must be established to assure general acceptance and use.

(d) *Quality*—a sharp, crisp, high-quality picture is essential because ITV is an extension of vision and its ultimate usefulness as a communicative device is effectively determined by picture quality.

(e) *Versatility*—the broad scope of practical application dictates that the equipment must have adaptability to meet style and operational requirements under an extreme range of conditions and locations.

Compared to its broadcast-studio counterpart, television for industry represents a greatly simplified system. A closed-circuit television picture can be transmitted using but two basic units. The camera connected by a length of coaxial cable to the viewing monitor is the essential system comprising any closed-circuit television hook-up.

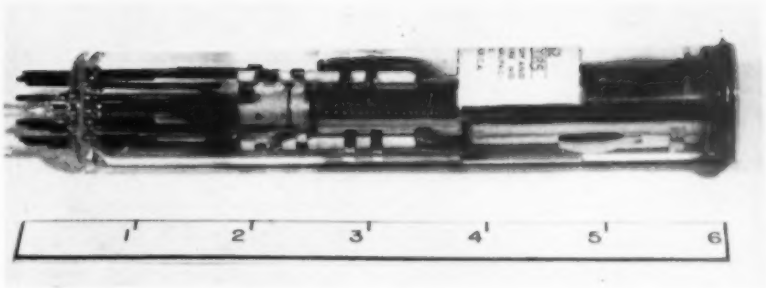
The camera houses a television pick-up tube and its lens. A popular camera tube, specially designed for industrial television, is a small, ruggedly constructed unit with spectral response characteristics very much like those of the human eye. Maximum response of the tube is in the blue-green region of the spectrum (4000 to 5000 A) and its light sensitivity can be compared to that of orthochromatic photographic film. Because of these characteristics, standard photographic filters can be used freely with the tube to permit observation of processes and objects which might otherwise be invisible

to the unaided human eye because of lighting conditions.

Operating costs of the tube are moderate ($0.16½ per hour) and are constantly being reduced through increases in tube life. Life expectancy of over 2100 hours can be reasonably assumed in normal operation. Life tests of over 4000 hours have been recorded for continuous operation with no apparent depreciation in picture quality.

The camera control combined with the viewing monitor, contains the picture tube upon which the camera scene is viewed as well as controls for the entire system. Centralizing all controls on the monitor offers the practical advantages of increased flexibility of application, accurate and easier service for maintenance or adjustment, and a generally simplified design with reduced numbers of components.

The camera and control monitor constitute the heart of any industrial television system, and it is here that performance is determined. Picture quality is generally evaluated on the basis of resolution and sensitivity. Resolution, or the ability to reproduce detail in the image is commonly measured on a standard Radio-Television Manufacturers Association test chart and is calibrated in terms of "lines." Resolution capabilities are determined by the optics and electronics of the system. The advantage of high resolution is more detailed reproduction of a larger area of a given scene. With a system of lower resolution, the camera would have to be placed closer to a given scene, or a lens of shorter focal length would have to be used for comparable resolution; either change would reduce the size of the televised area to be viewed.



High resolution, sensitivity, and spectral response much like the human eye, are features of the specially developed RCA Vidicon photo-conductive tube.

Camera with water-cooled lens is used to view furnace combustion.

Lighting Requirements

Sensitivity of a system determines the amount of subject lighting required to transmit a distinguishable picture. Up to a point, the more light on a scene the better the picture televised. However, a system that requires abnormally high light intensities cannot be practically considered for industrial television because versatility, an important ITV design characteristic, depends to a great extent on transmitting an intelligible image at relatively low light levels encountered.

Specific light requirements for an ITV system are generally determined by the camera picture pick-up tube. Distinguishable pictures have been transmitted with as little as 50 foot-candles incident scene illumination. A minimum of 100 foot-candles illumination is recommended to assure optimum performance for a leading tube type. Somewhat lower light levels have their major effect on the quality of the picture rather than determining if a picture can be transmitted.

For those instances where the camera views quickly moving objects, an appreciably lower level of illumination would introduce an element of lag in the picture. By maintaining scene illumination at the prescribed minimum, it is possible to realize the most effective benefits of a good lens because the iris can be stopped-down giving better depth of field in the picture transmitted. The blue-green spectral response of some pick-up tube types allows especially favorable operation under cool fluorescent lights.

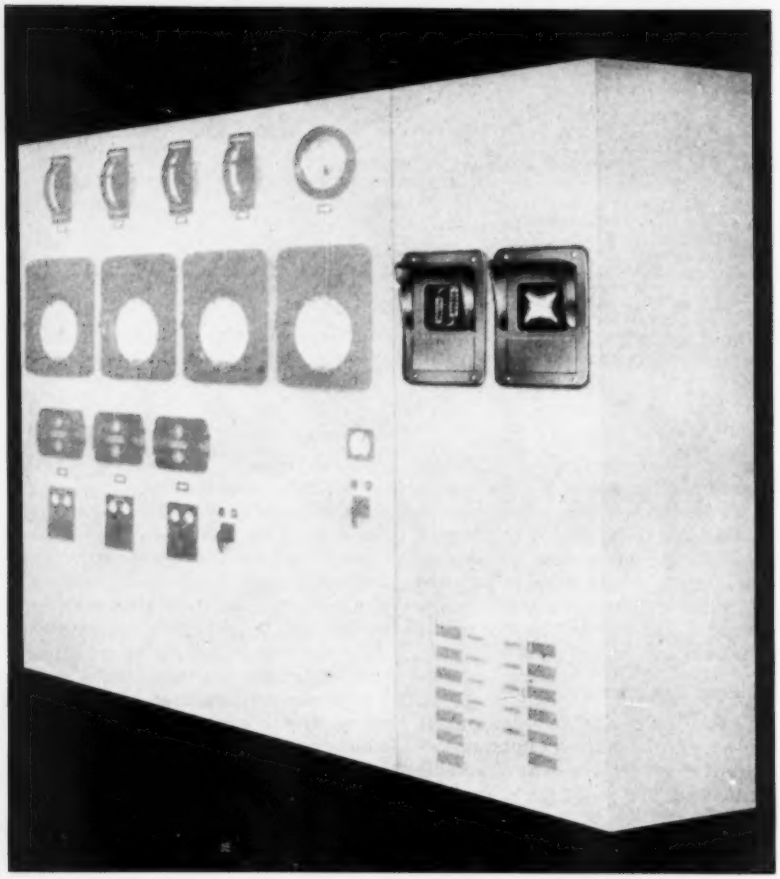
In many applications, accessories are required to increase the equipment's adaptability, versatility, and effectiveness. Evaluations from actual experience have shown the accessories listed below as essential for the widest industrial application of television: multiple lenses, auxiliary viewers, weather-proof camera housings, explosion-proof camera housings, underwater camera housings, camera switching equipments, remote pan and tilt mechanisms for the cameras, remote iris controls, water-cooled camera lenses, and shock mountings.

Most ITV cameras use 16 mm movie camera lenses which are readily available in a variety of types, from wide-angle to telephoto. The lens choice for a specific application is determined essentially by two factors; the area of the scene to be viewed and the distance from camera to the scene.

It may be necessary to increase either the number of viewing screens or the size of the picture being televised. To meet this requirement, auxiliary viewers can be connected to the control monitor by means of coaxial cable. These auxiliary viewers may be standard home television receivers or receivers of special design incorporating industrial styling features.

Camera Housings

Sometimes protective housings are required for the camera. An installation viewing a bomb loading operation, for example, requires that the camera be located in an explosive atmosphere and suitable protection is required. The railroads investigating closed-circuit television for monitoring freight yards require that the camera be located outdoors where it would be subjected to extremes of the weather. Therefore



ITV control monitors in the boiler control panel give the operator a direct view of furnace flame condition and remotely located water level gages.

to assure operation under such conditions, a weather-proof camera housing is available which includes a thermostatically controlled heating element and a windshield wiper.

A third type of camera housing is a unit developed for underwater use. It is a modification of the explosion-proof housing but fittings have been added to assure that all connections are watertight. This underwater housing can be used at depths up to 200 feet.

Additional Accessories

The line of ITV accessories continues to expand in response to industry needs. Camera switching equipment is designed to permit the use of several cameras with one monitor. Cameras can be located throughout a plant viewing several stages of an operation; the control or viewing monitor is located at the central control location. The operator selects the area which he desires to view. Several cameras can be spotted along a conveyor line, for example. In the case of a malfunction the operator could isolate the trouble by viewing along the conveyor with the camera.

Remote pan and tilt mechanisms are well suited for monitoring freight yards where it is often necessary to change the position of the camera to follow moving trains. A unit has been designed to enable the operator to remotely control the camera position. Remote iris control is a valuable accessory in any outdoor installation of the camera where changing light levels would otherwise be a problem. A remote iris control was developed which permits opening or closing the lens from a distance to meet the existing lighting conditions at the camera.

The water-cooled viewing port is a strict requirement in those applications where the camera is focused on the interior of a furnace. Shock mounting is a valuable accessory for applications where the ITV system is subjected to excessive vibration. Shock mounting units have been designed for both monitor and camera, to overcome the effects of excessive vibration of the units.

Applications

The following applications illustrate some of the present varied uses of industrial television. Flame observation within boiler furnaces is one of the outstanding applications of industrial television. The camera, protected from the intense heat by a water-cooled window, scans the interior of the furnace. The viewing screen is mounted on the boiler control panel. This arrangement provides the operator with more complete details of the furnace conditions than could be realized by any other means. One advantage of such a control device is that it instantaneously shows the operator any condition which might produce a furnace explosion; another is the assurance it gives the operator that all ignition is taking place and that all burners are functioning properly during lighting-off operations.

Power plant boiler gages are located several floors above the central control panel where the information is needed. The practice in the past has been to install intricate mirrors or instruments so the operator could see the gages. Such an arrangement has limitations and there always is danger of a faulty reading. With television, however, this possibility is eliminated; as long as a picture of the sight glass is being transmitted, the operator is assured accurate information.

A natural for closed-circuit television are those applications involving the handling and transporting of explosives or radioactive materials. Here again mirrors and elaborate optical systems have been replaced to permit more accurate viewing of dangerous operations.

Materials Handling

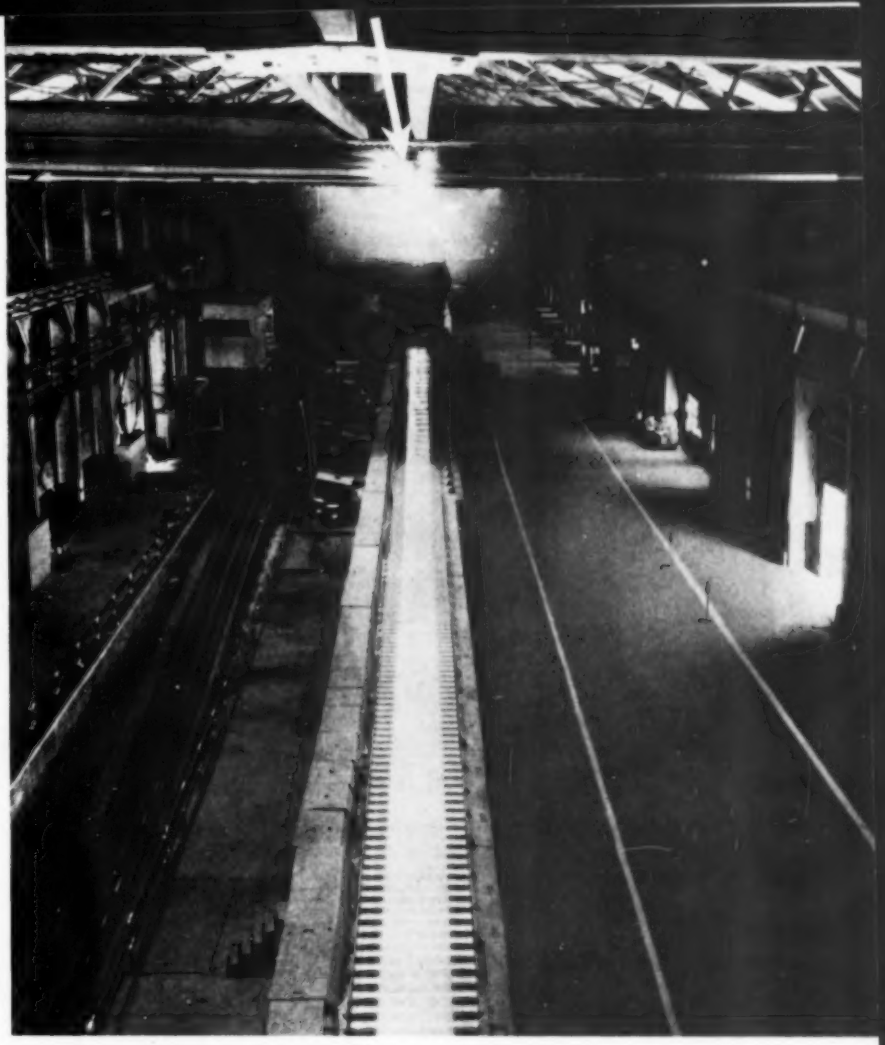
An excellent application of television to materials handling is in the Cadillac Motor Car division of General Motors. ITV is being used to observe remotely the loading of gondola cars with baling scrap. The operator, located some distance from the loading platform, can accurately move an empty car to the correct loading position, control the loading of scrap, and then remove the car when it has been filled. In this installation, the camera is located on the platform with the viewing screen remotely located at the baling control station.

More revolutionary in nature is an application of closed-circuit tele-

vision to mining. In the Freebrook Corporation mine at Kittanning, Penn., two ITV cameras are mounted on a coal digging machine. One is just behind the cutting tools in front of the machine. The second is on the rear of the unit facing back to observe a string of conveyor cars transporting the freshly dug coal to a point of accessibility. The scenes from both cameras are viewed by the operator, who may be 500 feet away. The camera at the front of the machine provides a constant check on proper operation, sharpness of the blades, obstructions, and so forth.The camera at the rear enables the operator to keep the conveyors, which are connected in train-like fashion, properly aligned.

At United States Steel Corporation's Gary Sheet and Tin Mill, ITV minimizes costly delays and improves the quality of the steel by providing the operator of the 80-inch hot strip mill with a constant view of the strip. Potential trouble due to cobbles and pile-ups is checked before it develops because necessary corrections can be made in time by the operator.

Another application, the charging of slab reheat furnaces, requires accurate positioning of the slabs being loaded into the furnace to avoid serious damage to the furnace walls. The old way of avoiding furnace damage relied on hand signals from a spotter. Now the TV camera provides the control operator with a continuous view of what previously had been blind spots.



A television camera, mounted on the rafters, records the progress of fiery rod steel strip as it travels from the finishing stand to the coilers.

Business Uses

The increased rate of business activity has necessitated expansion of many industrial operations. The prompt exchange of information may be limited, especially when companion departments are separated by considerable distances. Often it is necessary that several parties be able to view drawings, prints, correspondence, and so forth. Several large companies are investigating closed-circuit television as a means of solving this problem. Under such an arrangement, information to be discussed is scanned by a camera at one end of the system, and viewed on receivers.

Television manufacturers are constantly learning more about industry's requirements for closed-circuit television. Potential users are also becoming more aware of the practical and economic advantages of this medium. The novelty effect is wearing off. Today it is generally agreed that ITV has earned a berth in modern industry.

Voltage Displacement Melts Ice from Utility Lines

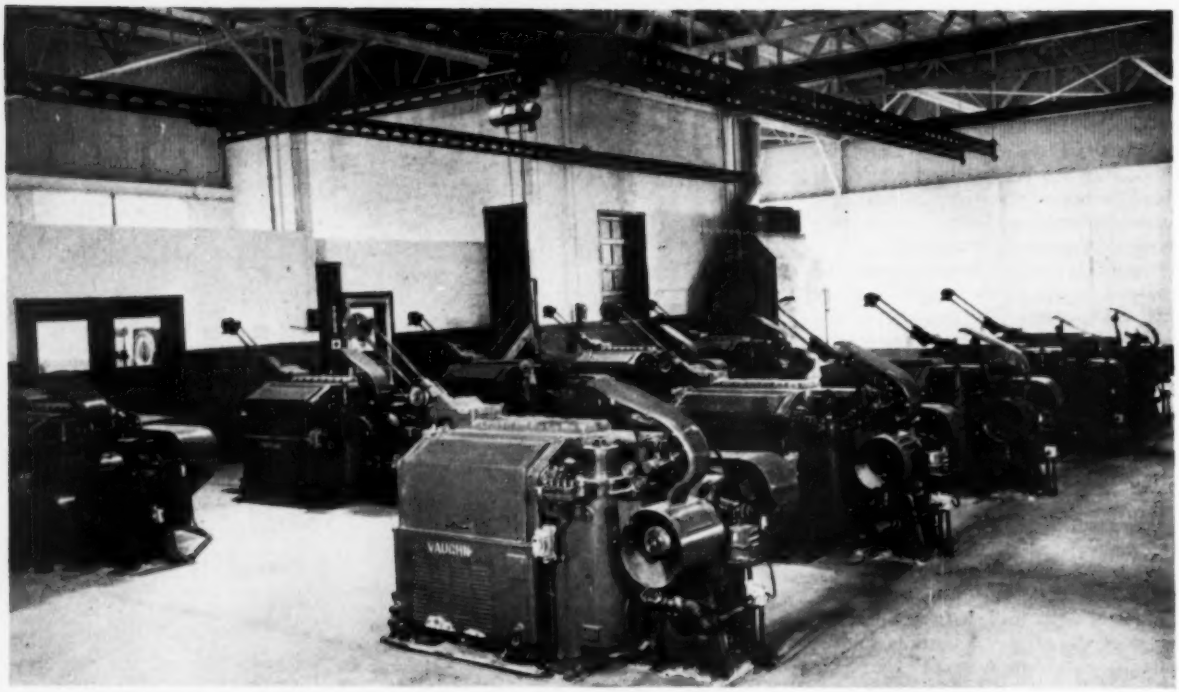
WHEN POWER LINES sag under the weight of ice and sleet, the system operator for the local utility has a number of choices.

He can take the lines out of service and de-ice them by overloading the lines—a move he is reluctant to make as his primary responsibility is to keep power flowing to the consumer.

Or he can try the relatively new procedure of angular displacement of the voltages to circulate sufficient current to heat the conductors and either melt or prevent the formation of ice.

"This method," O. L. Oehlwein of the Public Service Company of Chicago, told the Fall General Meeting of the A.I.E.E., "holds a great deal of promise for those long, lightly-loaded lines in the moderate and lower voltage class which so often fall prey to these storms."

"The circulating current produced by angular displacement," he said, "presents a method of melting the ice while maintaining service. By choice of line length and voltage this circulating current plus load current can be made sufficient to either melt the ice or prevent its formation. When regulating equipment is available and the angle does not exceed 60 degrees it is possible to hold the voltage level within reasonable limits.



Drawing operations in the new fine wire mill are coordinated by competent metallurgists to assure high product quality.

Savings By The Tank Car

In recent years, industry has come to appreciate the great value of anhydrous ammonia for many fields. The first wide-spread application was refrigeration. Now it is used: in mining to extract certain ores; in agriculture for ammoniated fertilizer (and lately for direct application of the liquid to the soil); in industry for the production of explosives, synthetic rubber, and plastics; in various forms of metallurgy; and in numerous other services. While this article describes a bright annealing operation, the information and cost comparisons can be used for all applications which require equivalent amounts of ammonia.

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MANY INDUSTRIAL USERS of anhydrous ammonia find that a bulk tank installation provides greater economy than a cylinder type system. One outstanding example is the new fine wire mill addition to the Sanderson-Halcomb Works, of the Crucible Steel Company of America, at Syracuse, New York. Operating experiences at this mill since its completion in 1952, accurately portray the multiple advantages of buying anhydrous ammonia in tank car lots.

Crucible's new mill is a model of efficient factory design. It contains the most modern equipment, including wire drawing machines and annealing furnaces. A special laboratory staffed with competent metallurgists coordinates all process operations. This integrated arrangement assures continuous, exacting control of the product quality.

Product Details

The plant was erected to produce fine gage stainless steel wire in diameters down to and including 0.009 in. Stainless steel wire is excellent for many applications. It is used for making surgical needles, seamless hosiery machine needles, and other important items. As efficient production techniques further reduce manufacturing costs, these products may be fabricated into insect screens, sponges, cables, and similar materials. In fact, its greater strength, superior rust resisting qualities, and

longer life expectancy eventually may cause it to replace less desirable materials in numerous products. A typical procedure for fabricating fine stainless steel wire, which conforms to AISI Type 302 Specification (18 percent chromium-8 percent nickel), is described in Table 1.

TABLE 1 — A TYPICAL PROCEDURE FOR MANUFACTURING STAINLESS WIRE

1. One-quarter inch diameter wire rods are delivered from the rod mill of the Sanderson-Halcomb Works in bundles weighing approximately 150 lb.
2. Each bundle is annealed in a batch type, natural gas fired* furnace at approximately 2000 F and quenched in water which leaves the rods quite soft. They are pickled in a hot caustic bath followed by several water rinses and an acid rinse, and then they are lead coated by immersion in a molten lead bath.
3. The ¼-in. rods are pointed and cold drawn continuously on multiple spindle Vaughn machines through tungsten carbide dies to 0.110-in. diameter and then deleaded.
4. The 0.110-in. wire is annealed by passing through a 20-tube, continuous strand annealing furnace surrounded by a hydrogen protective atmosphere and cooled by passing through additional tubes submerged in water. It then passes through an immersion lead bath to be lead coated before being rewound.
5. Annealed and lead coated 0.110-in. wire passes through tungsten carbide dies on a Vaughn machine and is reduced to 0.051-in. diameter and rewound. Bundles are cut into smaller sizes for ease of handling, after which they are deleaded.
6. Deleaded 0.051-in. wire is again annealed in a 20-tube continuous furnace where a hydrogen atmosphere protects the bright finish.
7. The 0.051-in. wire is then cold drawn through multiple pass Vaughn machines to the required finish diameter. In the drawing of wire sizes under 0.030-in., diamond drawing dies are used. Finished wire is shuttle wound on spools in lengths of approximately ¼ mile.

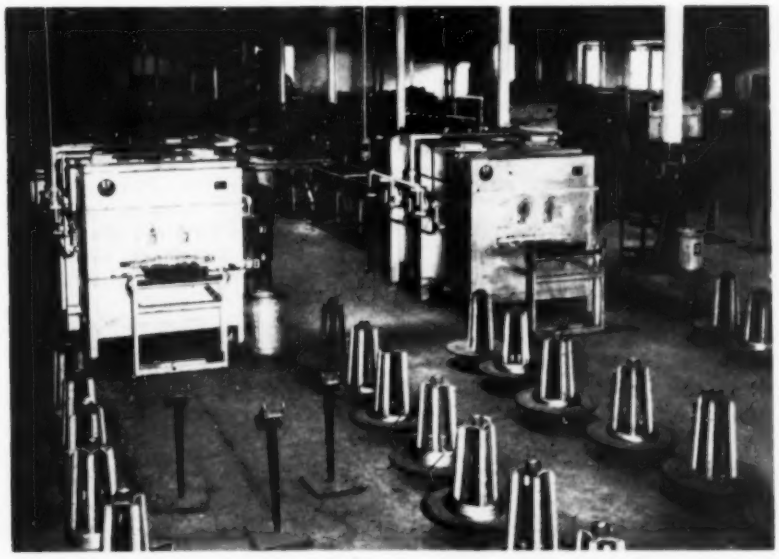
*Gas fired equipment normally uses natural gas on interruptible rate service. A propane-air gas standby plant, installed by the author, provides fuel during curtailment periods and assures continuous production.

Cylinder System

When the fine wire mill was designed, the engineers planned to buy the necessary anhydrous ammonia for producing the desired protective furnace atmosphere in conventional 150-lb cylinders. They provided storage space and installed a rack for connecting cylinders to two dissociators which produce dissociated NH_3 protective gas for annealing operations. Since the capacity of each dissociator is 1000 cfh of NH_3 which, when dissociated, will form 2000 cu ft of mixed gas containing 75 percent hydrogen and 25 percent nitrogen (no attempt is made to remove the nitrogen and it is allowed to remain in the protective atmosphere as an inert gas), this system involved extensive storing and handling of cylinders.

Operating Results

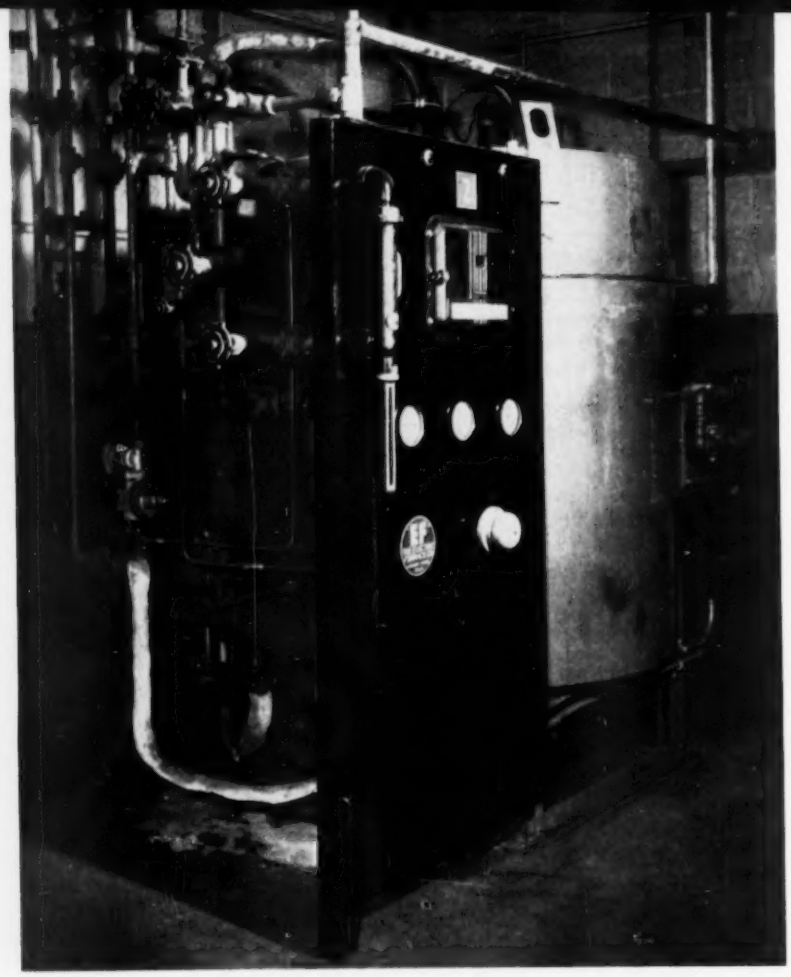
Using anhydrous ammonia in cylinder form proved to be very expensive as several unexpected costs developed with actual operating experience. First, since normal processing is at 50 psig pressure, considerable amounts of liquid ammonia remained in the disconnected cylinders and could not be recovered. Second, because of the operating pressures and the necessity for continuous flow, the relief valves often discharged when changing from one cylinder to another. This lost appreciable quantities of ammonia and caused personnel disturbances which sometimes emptied the mill. Third, after several months of operation, the company estimated their labor cost for handling cylinders was $180.00 per month or, based on consumption, an average of 1.69¢ per pound. In view of these conditions, Crucible officials decided to install their own bulk plant and buy anhydrous ammonia in tank car lots.



These 20-tube annealing furnaces can handle 110 lb of stainless steel per hr.

Bulk Plant Tank

A standard size (18,000 gallon water capacity), horizontal storage tank was installed, complete with relief valves, excess-flow valves, shutoff valves, liquid level gage, and all other accessories which are required to comply with safety standards. The tank is painted white to reflect the heat rays of the sun, and has manually controlled water sprays along the length of the top for cooling in prolonged hot summer weather. Maximum liquid ammonia capacity is approximately 42 tons, or 16,000 gallons. Since standard tank car shipments are approxi-



Dissociated NH_3 provides the protective atmosphere for annealing fine wire.

mately 26 tons, this leaves an excellent, 16-ton margin of safety in the storage tank.

Unloading Compressor

When tank cars arrive, their contents are unloaded by an ammonia vapor transfer compressor with a 4-way valve assembly. This compressor has iron, steel, or stainless steel parts at all points where there is contact with the ammonia because bronze, copper, brass, and many other materials cannot be used for this service. Accessory equipment includes a separator, which removes any oil that may be present in the ammonia, and pressure gages on both the intake and discharge sides of the compressor. The 4-way valve assembly permits the intake and discharge connections to be switched from the tank car line to the storage tank line or vice versa.

Ammonia for initial operations was supplied by this 150-lb cylinder system.

Unloading Rack

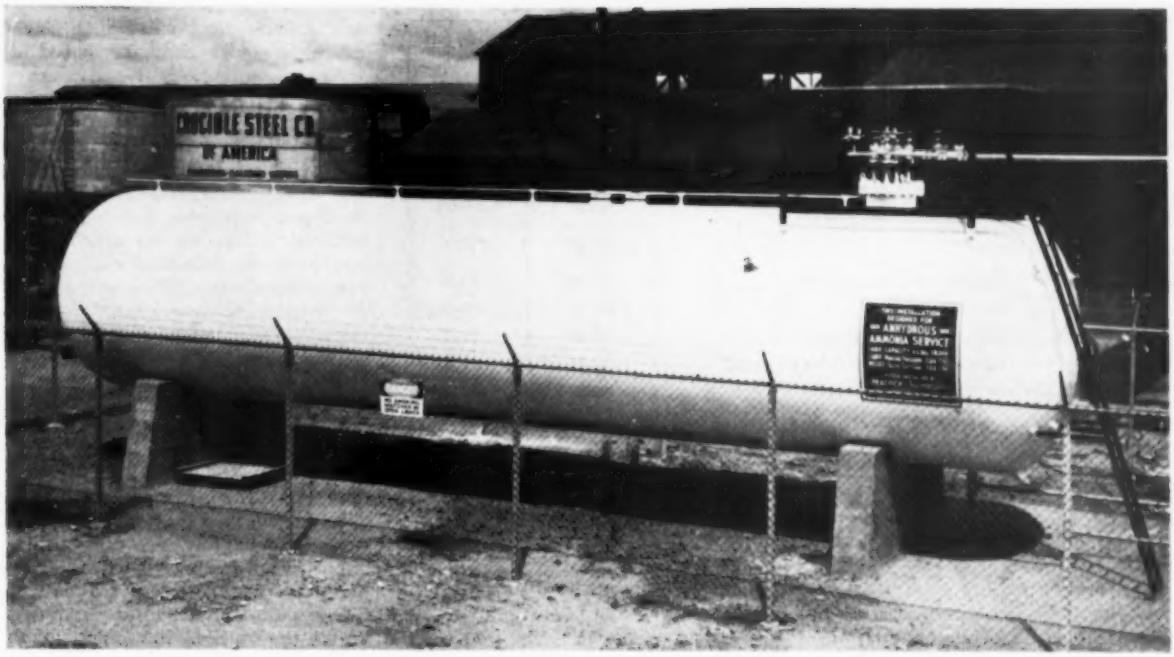
An unloading rack set up next to the railroad siding is the focal point for controlling the transfer of ammonia from tank cars to storage. A 2-in. liquid line connects this rack with the storage tank. The line has an external shutoff valve at the storage tank and a spring-closed, back-flow check valve inside the tank. At the unloading rack, the liquid line contains a shutoff valve, cast steel strainer, and cast steel sight-flow gage with tempered glass window. In addition, the rack is equipped with fittings for connecting two 1½-in. extra heavy ammonia hoses to the liquid eduction valves on the tank car.

The necessary vapor line from the compressor also terminates at the unloading rack, the other end extending from the compressor to the storage tank. This line has a shutoff valve and a fitting for attaching an extra heavy ammonia vapor hose to the vapor repressuring connection on the tank car at the unloading rack. The storage tank end divides into two connections, one of which has an internal dip-tube that extends to the bottom of the tank. Both connections have proper shutoff and check valves.

Unloading Procedure

When unloading ammonia, the tank car contents are checked with the gage tube on the car, and the liquid temperature is measured for temperature conversion. Liquid and repressure hoses from the rack are connected to the tank car, and the liquid unloading valves on the tank car are opened. Then, the operator opens the liquid valve at the rack while observing the sight-flow gage to determine flow from the tank car. Usually, a full tank car has higher pressure than the storage tank, and transfer can begin without using the unloading compressor.

Once the proper flow rate has been set by the liquid valve at the rack, the vapor valves on the tank car and storage tank are opened. Valves at the unloading compressor are opened, and the 4-way valve is set to take vapor from the storage tank and transfer it to the tank car. The gages on the compressor will indicate the tank car and storage tank pressures. When the differential between the tank car and storage tank



Approximately 42 tons or 16,000 gal of liquid ammonia can be stored in the 18,000 gal (water capacity) bulk plant tank.

pressures drops to about 25 psig, the unloading compressor is started so that a minimum differential of 10 to 25 psig is maintained. A higher differential is undesirable because it may produce too high an unloading rate which would close the excess-flow valves in the tank car. Liquid unloading time is approximately three to four hours, the complete unloading being shown by the sight-flow gage and also by the storage tank liquid level gage, which should indicate a total increase of about 10,000 gallons.

Reclaiming Vapor

After the liquid has been unloaded, a considerable amount of ammonia remains in the tank car in vapor form, the exact quantity depending upon the pressure of the vapor. To salvage this ammonia, the liquid lines are disconnected and the 4-way valve on the compressor is reversed so that the suction is from the tank car. Then the remaining vapor in the tank car is transferred to the storage tank. The check valves at the storage tank are arranged so that the vapor passes through the valve having an internal dip-tube and bubbles up through the liquid in the tank. This cools and condenses the vapor thereby preventing excessive tank pressure build up which might result if the vapor were compressed in the top of the tank. Vapor reclaiming time usually is about three hours, depending upon the pressure. Thus, the total time for unloading a tank car and reclaiming the vapor is slightly under eight hours, and one employee can handle all operations.

Liquid Pumps

Crucible's process operations utilize ammonia at approximately 50 psig, which is comparable to a liquid temperature of about 32 F. Since the plant is in a relatively cold climate, this means the ammonia must be artificially pressurized in the winter. Therefore, two small liquid pumps with ½-hp motors were installed for this service. These units are mounted outdoors at the storage tank where they receive liquid from the bottom of the tank by gravity flow. Each pump delivers 3 gpm of liquid ammonia at a differential pressure of 50 psig. which is equivalent to about 4000 cfh of NH_3, or four times the present maximum process consumption rate.

One pump is controlled automatically by a high and low limit pressure switch. When the storage tank pressure drops to 50 psig, this switch starts the pump which automatically takes over the load. A check valve arrangement permits this procedure without manipulating shutoff valves. When the weather moderates and storage tank pressure increases to a predetermined value of 60 psig, the switch automatically stops the pump and direct flow from the tank resumes. This pump assembly is protected by a differential pressure regulator which returns excess ammonia to the storage tank. A fixed orifice between two flanges furnishes a constant purge back to the vapor space of the tank and removes any possible vapor from the pump housing.

Relief Valves

In addition, both liquid pumps are protected by relief valves against any excessive pressures that would develop if valves were closed causing a hydrostatic pressure condition. A total of four valves, two for each pump, are installed. Each pair is connected through a 3-way valve so that only one valve can be shut off at any one time while the other must remain in service to protect the pump. Similar hydrostatic pressure protection is installed in all other liquid lines, with dual valves connected to a 3-way shutoff.

Extra heavy seamless pipe and nipples were used for the entire project. All valves larger than ½ in. are of the socket-weld flange type. Fittings are flanged or welded so the installation is of almost completely welded construction. After erection, all lines were tested at a minimum of 250-psig pressure with nitrogen and given a shut-in test as well as a bubble test.

Crucible used both the cylinder

TABLE 2 — ESTIMATED ANNUAL COSTS FOR AMORTIZING BULK PLANTS

Size of tank, water capacity in gallons	18,000	30,000
First cost of plant	$ 20,000.00	$ 25,000.00
Less salvage value of tank after 30 years	780.00	1,200.00
Balance after salvage value	$ 19,220.00	$ 23,800.00
Annual 5 percent interest on salvage value	$ 39.00	60.00
Annual sinking fund for balance	$ 1,215.22	$ 1,549.38
Compressor replacement ($1000) every 15 years*	$ 46.30	$ 46.30
Unloading hose replacement ($300) every 10 years*	$ 23.35	$ 23.35
Repainting ($400 & $600) every 4 years*	$ 92.80	$ 139.20
Total fixed costs per year for plant	$ 1,416.67	$ 1,818.23

*Values are the annual amounts required to amortize the equipment during the stated time plus 5 percent interest.

system and the bulk plant long enough to establish the operating costs for each method. These costs may vary at other installations, but the saving should be about the same. More ammonia must be purchased with the cylinder arrangement because of the losses encountered with this method. However, these losses cannot be estimated accurately. Therefore, for purposes of comparison it will be assumed that actual ammonia consumption is identical within either system.

Cylinder System Costs

Records show the cylinder system required an average of 10,607 lb of ammonia per month over a period of three months. During this time labor cost for handling cylinders was $180 per month. The cost of ammonia was 17¢ per lb delivered at the plant. This will give the following monthly cost figures:

10,607 lb at 17¢ per lb	$ 1,803.19
Handling cost	180.00
Total monthly cost	$ 1,983.19
Average cost per lb	18.69¢

Bulk Plant Costs

When establishing handling costs for the bulk plant, it was assumed that the operator does no other constructive work during the 8-hr unloading time for a standard, 26-ton car. Using an estimate of $20 for this labor, the handling charge is 77¢ per ton. In addition, power is required for the 5 hp motor on the unloading compressor. If the motor is fully loaded this cost would be 5 hp x .746 kwh per hp x 8 hr x 1½¢ per kwh = 45¢ or approximately 2¢ per ton. Adding these values to the delivered price of a tank car gives the following costs per ton of ammonia:

Ammonia per ton	$ 83.30
Freight per ton	5.75
Labor	0.77
Power	0.02
Total cost per ton	$ 89.84
Average cost per lb	4.492¢
Cost of 10,607 lb	$ 476.47
Monthly saving	$ 1,506.72
Annual savings	$ 18,080.64

Based on an installed cost of approximately $20,000 and the indicated consumption, a bulk system could be paid for in 14 months of operation. This does not take into account interest and depreciation or the necessary investment in associated services.

Realizing that many industries use varying amounts of ammonia, tables and graphs are included so engineers can make estimates based on their own conditions. When preparing these data[1], only one variation was made from the costs established at the Crucible installation. There the cylinder handling charge of $180 per month approximates 1.69¢ per lb. For convenience this value was reduced to 1.5¢ per lb, which when added to the delivered cost of 17¢ per lb equals the $370 per ton price of cylinder ammonia used for the calculations.

Basis of Calculations

While normal installations seldom require more than an 18,000 gallon (water capacity) tank, Table 2 also includes figures for a 30,000 gallon tank. All estimates are based on accepted annuity tables[2] using the assumption that the necessary money is borrowed and paid back over the life of the installation plus 5 percent interest. Furthermore, the estimated life of the various equipment items is as follows:

Storage tank	30 years
Unloading compressor	15 years
Unloading hose	10 years
Outside paint (tank and piping)	4 years

These values are very conservative. The life of the tank if kept painted is unlimited, as is the life of a compressor that is used only 8 hr with each tank car delivery. Hose would have to be replaced because of age rather than usage, and painting certainly would not be required more often than every four years.

Comparative Costs

Two charts were prepared to show comparative costs. Fig. 1 illustrates the break even point in annual am-

TABLE 3 — AMORTIZATION TIME WITH VARIOUS ANNUAL LOADS

Ammonia consumption tons per year	*Equivalent number of 150-lb cylinders*	*Amortization time, years at 5 percent interest*
5.06	67	30
5.57	74	25
6.20	83	20
7.30	91	15
9.57	128	10
12.50	167	7
16.50	220	5
22.30	297	3

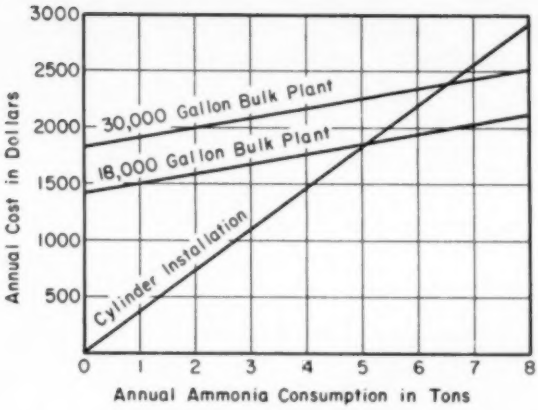


Fig. 1—Comparative costs for cylinder and bulk plants.

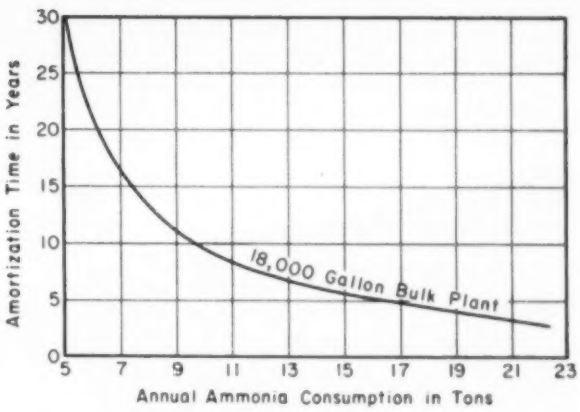


Fig. 2—Amortization time for an 18,000 gal bulk system.

monia usage based on the annual bulk plant costs listed in Table 2. The curves for 18,000 and 30,000 gallon installations start at their respective fixed annual bulk plant costs and increase by the value of the annual consumption at a rate of $89.84 per ton. The cost of the cylinder ammonia is a straight line increase based on $370 per ton and assumes no capital investment is necessary. It may be surprising to many engineers to note that the 18,000 gallon installation would have a break even point in cost, as compared with the cylinder ammonia, at an annual consumption of only 5.06 tons. This would be one tank car of ammonia about every 5 years. The break even point for the 30,000 gallon installation would be only 6.47 tons, although this size tank would not be installed in any but very large applications.

Fig. 2, based on the same data, shows the length of time required to pay out an 18,000 gallon installation at 5 percent interest with various annual ammonia consumptions. This curve dips sharply from the break even point of 5.06 tons and 30 years to the point where annual consumption has increased to 10 tons. Then it starts leveling out so that with an annual load of 22.3 tons, the plant will pay out in three years with interest. Table 3 presents the exact values for selected amortization periods to assist in reading the curve more accurately. In addition, the annual consumption in tons has been converted to show the corresponding number of 150-lb cylinders per year.

Conclusions

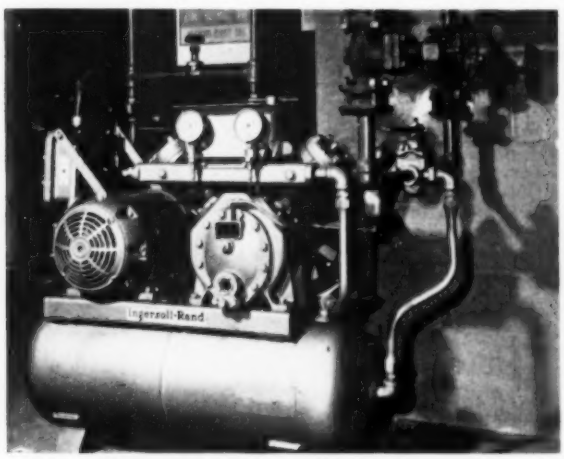
These data indicate that any industry using as much as one tank car (26 tons) of ammonia annually can pay for a bulk plant in three years or less. This is equivalent to less than one cylinder per day. Based on a ten year amortization period, a company using as little as 2½ cylinders per week can afford to install a bulk plant. Furthermore, these figures do not include other obvious savings, such as the elimination of cylinder losses when using a bulk system.

ACKNOWLEDGEMENTS

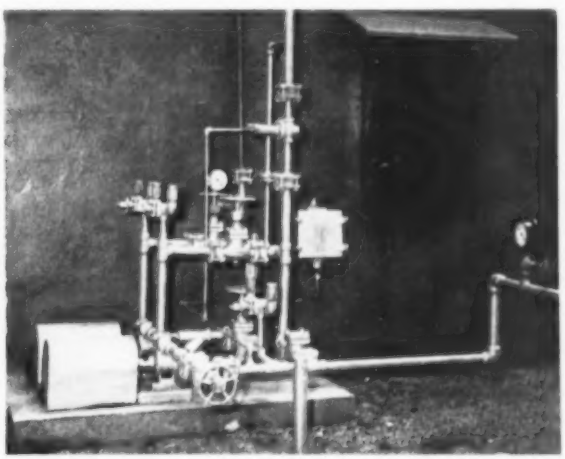
(1) Robert J. Ballis, 33 Park Ave., Maplewood, New Jersey, Registered Professional Engineer in New Jersey and New York, prepared the tables and graphs showing comparative costs.

(2) Annuity tables used for the calculations are in Eshbach's "*Handbook of Engineering Fundamentals*," Table 7, P. 2-45 and 2-46.

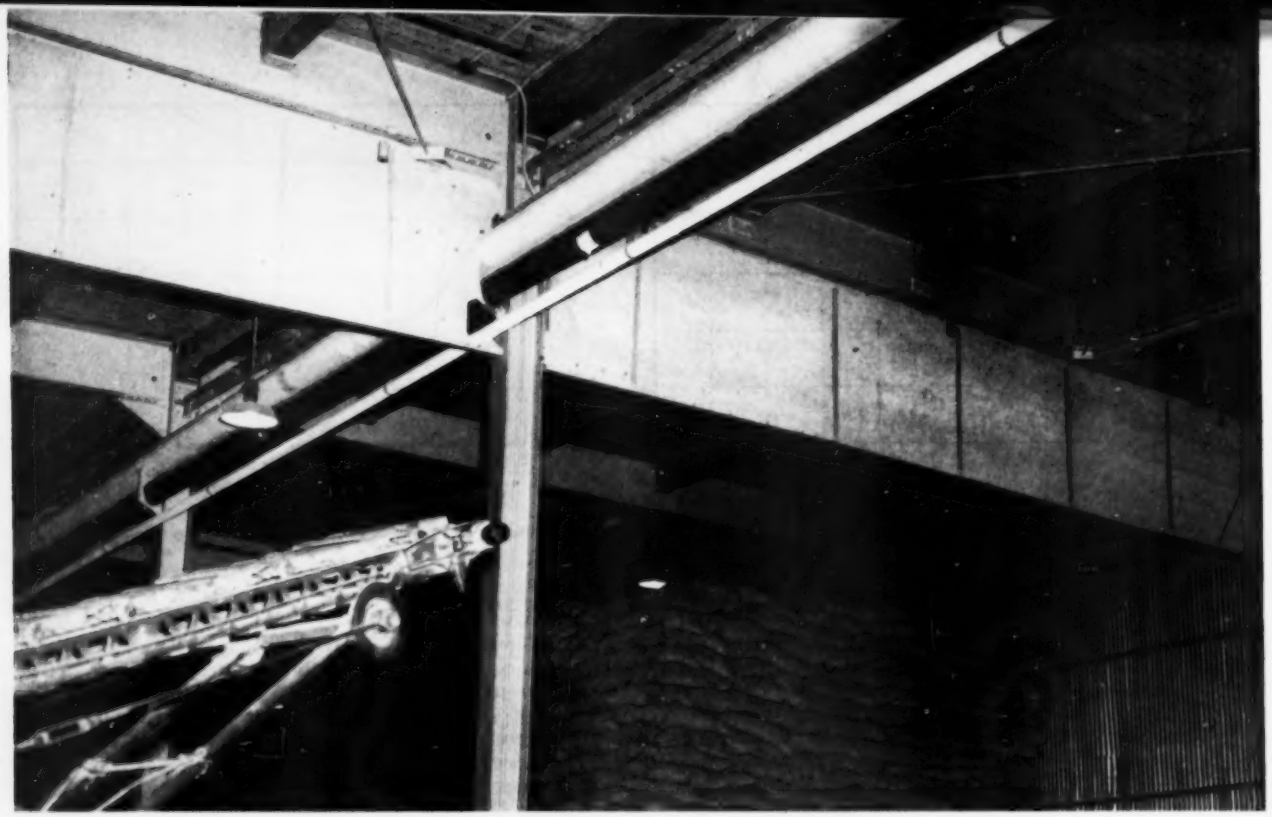
Appreciation is expressed to the officials and employees of the Sanderson-Halcomb Works of the Crucible Steel Company of America for their cooperation in supplying data from their operating records.



Tank cars are unloaded by a vapor transfer compresser.



Liquid pumps maintain 50-psig tank pressure in winter.



A fire curtain of non-combustible material — which hangs across the entire width and about 4 ft below the ceiling of this warehouse — prevents heat from a localized fire from travelling length of building and actuating all sprinklers.

Engineered Fire Protection at Corn Products Refining Co.

Personnel, operations and facilities at the Argo Plant are protected against fire by carefully planned and engineered alarm and protective systems. Covering process, storage and handling activities, their program retains its flexibility in spite of constant plant expansion.

ADEQUATE AND RELIABLE sprinkler protection in a plant that embraces activities ranging from process to warehouse operations—which have expanded continuously since 1908—characterizes the installations at the Argo plant of the Corn Products Refining Co.

There are some 71 buildings scattered over 290 acres at Argo. Here, raw corn is processed into a variety of products such as feed, meal, starch, sugar, syrups, salad oil, and jelly. The plant was originally built as an independent and integrated unit with most of its own utilities and services. Because of the potential fire hazards involved in manufacturing, storing, and handling these products, 95 percent of the buildings are of fire-resistive concrete construction and 3 percent are conventional all-steel construction.

Corn Products Refining Co., cooperating with the National Fire Protection Association, has followed the recommendations of the Association by installing (in conjunction with other protective measures) specified sprinkler systems in the various buildings. This gives them the security of protecting their operations and personnel against fire.

Five general types of sprinkler systems are used:

(1.) *Wet Pipe System*—an automatic sprinkler system used in buildings that are heated (where there is no danger of water in the pipes freezing). The entire system is filled with water, usually at a pressure between 115-125 psi. When

the sprinkler heads are fused open by heat, usually 165 F, the water is immediately discharged.

(2.) *Dry Pipe System*—an automatic sprinkler system used primarily in unheated buildings. The piping system contains air under pressure. When sprinkler heads fuse open, this air is released permitting the water to open a main valve controlling the system. This valve is commonly known as a "dry pipe valve" and when it operates, water flows into the system and out of the open sprinkler heads. There is a time delay of from 6 to 10 seconds after the sprinkler head opens before water is actually discharged.

(3) *Mulsifyre System*—either a wet or dry pipe system. The primary difference between the "mulsifyre" system and the wet and the dry pipe systems is that the sprinkler head for the former discharges a fine mist or water spray instead of the heavier spray. The "mulsifyre" system is installed where there is a potential danger from oil fires.

(4.) *Deluge System*—basically a dry pipe system. However, the sprinkler heads are kept open all the time. Heat actuated devices, commonly called H.A.D.'s, are installed in the same areas as the sprinklers. When their mechanism is tripped by a sudden rise in temperature, they operate a system valve which allows water to flow into the pipes and through the open sprinklers to deluge the protected area with water.

(5.) *Cardox System*—releases carbon-dioxide to extinguish electrical fires. This system is installed mainly in powerhouses to protect the generators and switchgear.

In general, the Corn Products plant uses the wet pipe system (24 systems throughout the plant) in its heated warehouses and packaging and bottling plants. The dry pipe system (41 throughout the plant) is used in all unheated warehouses and loading sites. The Mulsifyre system (3 throughout the plant) protects the oil filters and settling tanks in the powerhouse and also certain distillation equipment in the refining processes. The deluge system (only 1 in the plant) is used in hazardous areas where the gases and liquids involved in extraction processes can explode or catch fire. The Cardox system protects the generators and switchgear from electrical fires that may start internally.

Air pressure on a dry pipe valve is checked by the maintenance man making his daily rounds. This valve has an accelerator device for quick opening.

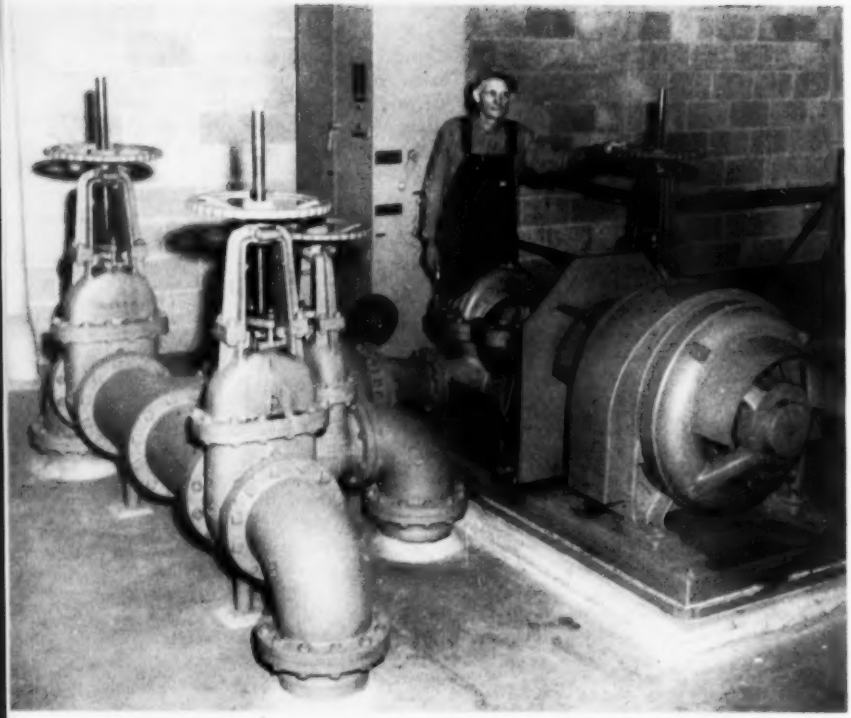
While there are given standards and codes for the installation of sprinkler protection, each building has its own peculiar fire hazards depending on its function, structural layout, facilities—all of which must be taken into consideration when specifications are drawn up. Existing systems and future expansion are two other important factors that guide the sizing and layout, of the networks as well as the water storage and pumping capacity.

The entire plant area has been looped by 10 and 12 in. pipe. These loops are so arranged that any one section may be shut down for inspection and maintenance without seriously affecting the rest of the system. In the event of a fire, if one sector of the loop is disrupted, the sprinkler system can still be fed from another direction of the loop. Shut-off valves are placed in strategic positions of control, most of them being readily accessible from the outside of the buildings.

When a fire occurs and a sprinkler head opens, a horn or bell alarm sounds in the building. In some places, this alarm is also located on the outside to attract attention in the event that there is a fire during the night when there is no personnel in the building. At the present time a project is being developed to install an annunciator system with alarms on the outside of all sprinkler protected buildings.

A generally accepted limiting criteria of a number of sprinkler heads that can be used in any one system is 400 with a capacity flow of 500 gpm. This assumes a 6 in. control valve or dry pipe valve which is a manufacturers' standard item and which has been used throughout the Argo plant sprinkler systems. If an accelerator, which is a special device to trip or open the dry pipe valve quickly, is installed with the dry pipe valve, 500 sprinkler heads may be used with a capacity flow of 750 gpm.

In some of the warehouses, which are very long and have more than one sprinkler system, a fire curtain is used to separate the areas protected by each system. The fire curtain is a thin wall of asbestos or other non-combustible material which hangs about 4 ft below the ceiling and across the buildings' entire width. Without a fire curtain, if a localized fire breaks out, a heat wave



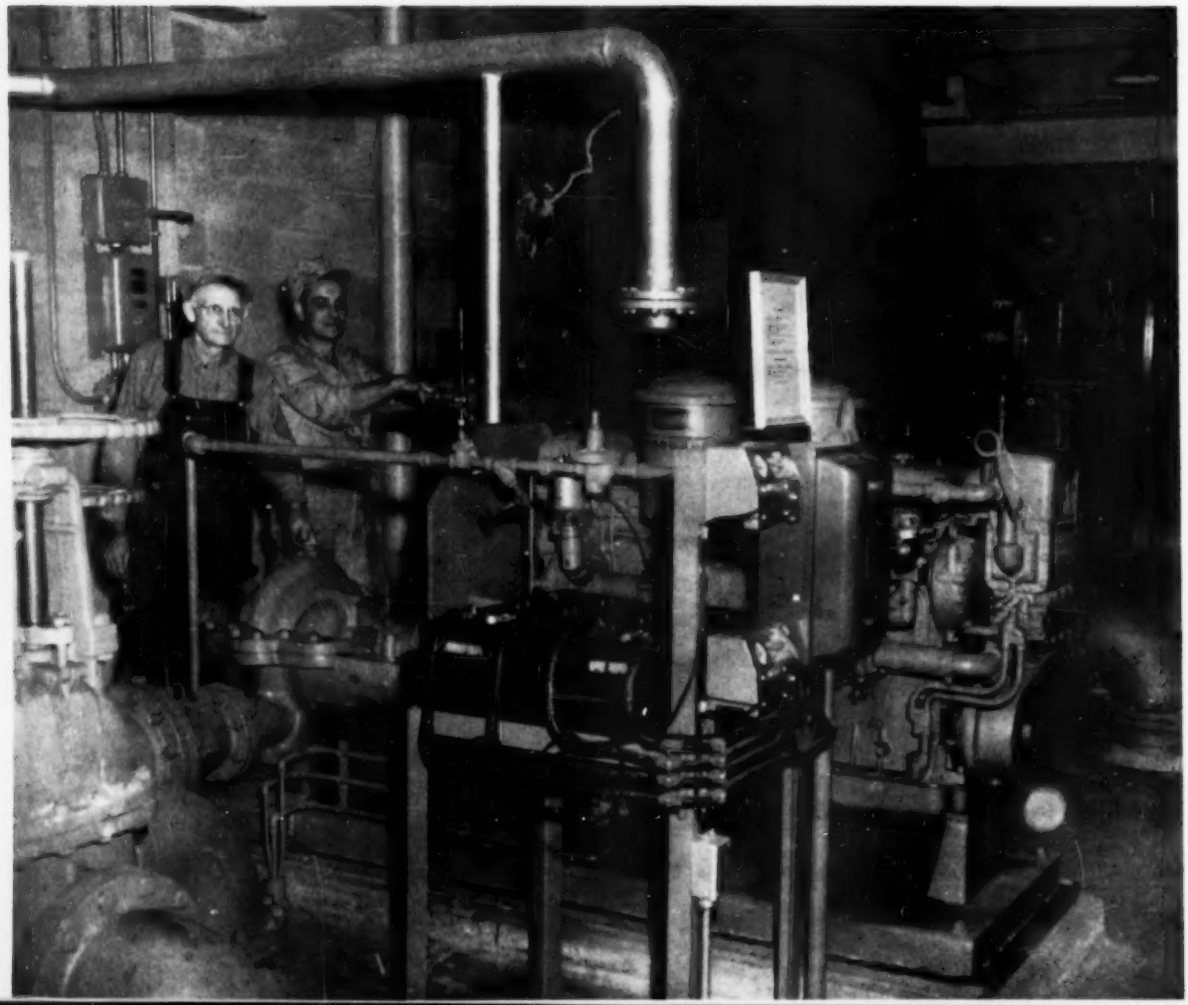
A standby automatic electric fire pump helps maintain constant water pressure in the fire line system.

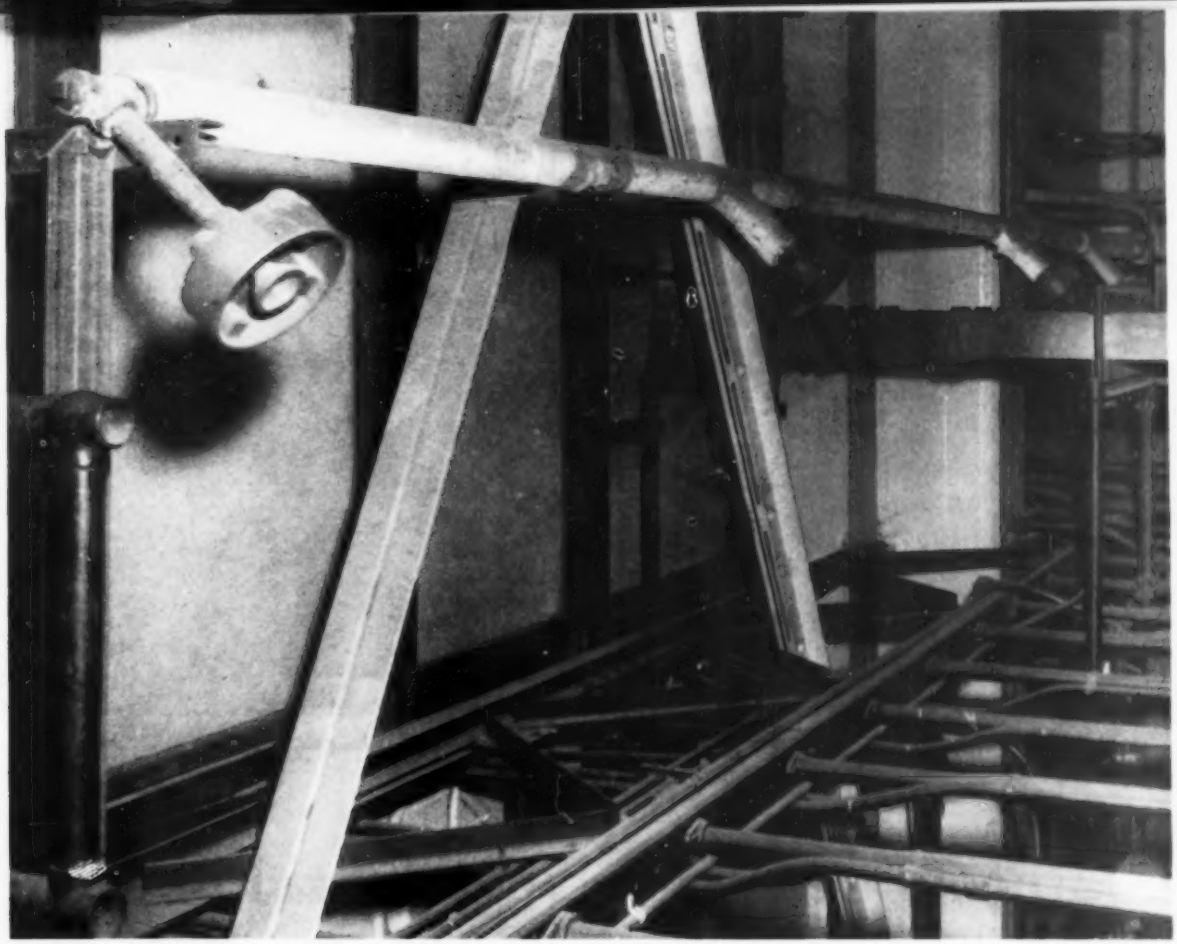
may travel rapidly along the ceiling setting off more sprinklers than necessary to control or extinguish a fire. A fire curtain will effectively confine the heat wave to the area in which the fire occurs and thus prevent extensive water damage.

The fire protection system draws its water supply from three sources. A 24 in. city main feeds two reservoir tanks, each with a capacity of 2 million gallons. The water from these tanks can also be used for process needs, however, 250,000 gallons in each tank are reserved for the fire protection system. They cannot be used by the process water pumps because these pumps do not take suction below the 250,000 gallon mark.

Four ground water wells, originally used before city water was available, are now used as standby supply. Each well has a capacity of 1000

In the event of complete failure, this diesel driven centrifugal pump can hold a limited pressure in the system.





The Cardox CO_2 system shown protects the bus bar, switchboard and generators in the power house from electrical fires. A sudden rise in temperature will open these sprinkler heads, allow the CO_2 foam to smother and put out the blaze.

gpm to be used during an emergency.

At the center of the plant is an old underground reservoir with a capacity of ¾ million gallons, now used primarily for process water, but in an emergency can be diverted for fire protection requirements.

Two steam pumps with 1000 gpm capacity each at 125 psi operate continuously to maintain pressure in the loop system. A centrifugal pump with 2000 gpm capacity at 125 psi cuts in whenever the loop pressure falls below the required 95 psi.

In the new pump house, recently built on the outskirts of the plant site along with a new boiler house and the two reservoir tanks, are two identical pumps each with 1500 gpm capacity. One pump is on a standby basis and is electrically driven. Should the pressure in the system drop below 110 psi, it automatically cuts in and operates for 7 minutes or until pressure is up to normal. It can also be controlled manually. The other pump is diesel driven and is solely for emergency power failures. It is controlled manually.

In case of complete failure of power and other utilities, two 50,000 gallon gravity tanks located on the tops of two separate buildings can still feed the sprinkler systems with water at approximately 80 psi.

The total capacity of the pumping system is 7000 gpm which is well above recommended capacities and more than adequate to meet the foreseeable future expansion program requirements.

Because of the hazardous conditions that prevail in the extraction and refining operations involving hexane, these operations are all confined to one building which is set apart from the other buildings in the area. Entrance is restricted to the operating and supervisory personnel. Smoking or carrying of lighters is forbidden. In the multi-storied construction, the floors are made of grating, making it possible to saturate the entire structure with water. A number of automatic warning and alarm systems are installed. Provision is also made for rapidly dumping the highly inflammable liquids to an outside storage tank.

Sprinkler protection for this building consists of three major divisions —(1) a standard wet-pipe system on the preparation equipment; (2) a Mulsifyre system on the distillation equipment; (3) a deluge system on the extraction equipment. These systems are actuated automatically by various heat and smoke responsive devices. They can also be operated manually but are protected against tampering by an alarm system which is automatic.

Two full-time maintenance men inspect and maintain the sprinkler systems. They check water and air pressures in both the dry and wet systems. Sprinkler heads are tested annually. A normal cleaning routine is scheduled and followed through. In addition to their own maintenance men, the fire and sprinkler protection system is carefully checked by the insurance agents.

To illustrate the effectiveness of the sprinkler system: an accident causing a fire in a mixer hopper took place last June. The resulting fire immediately actuated thirty sprinkler heads and in a matter of minutes the fire was extinguished.

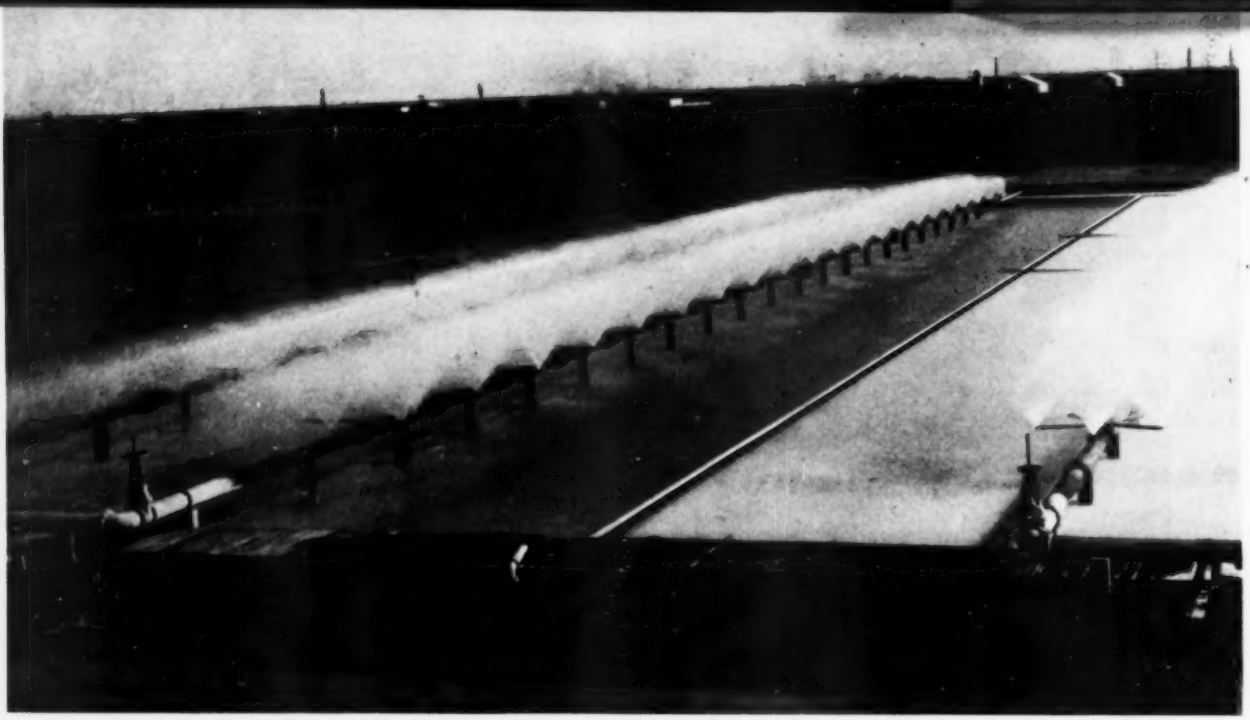


Fig. 1—This typical spray pond is installed at a large power company in Texas. The system has a total of 420 spray nozzles to

Recooling Water in Spray Ponds

K. S. ROBERTS, Mechanical Engineer
Yarnall-Waring Company

RECIRCULATING recooled water to condensers, engine jackets, refrigeration coils, and other cooling equipment is recommended for all installations where a continuous fresh water supply is not available from natural sources, or where city water is too costly for a once through system. Such recirculation of water permits great savings in operating costs and increases over-all efficiency. Furthermore, actual water consumption is reduced to the amount required to replace the heat dissipating medium losses.

Spray Pond Cooling

A properly designed spray pond will insure complete dissipation of the heat absorbed in condensing and cooling operations. With this arrangement cooling is accomplished through conduction, radiation, and evaporation, although the major portion of it results from the evaporation of a part of the sprayed water. Under constant load conditions, the heat absorbed in a condenser or other apparatus is dissipated in the pond. Any temperature rise in the condenser is offset by a temperature reduction in the spray pond, and consequently these two units operate as a balanced cycle.

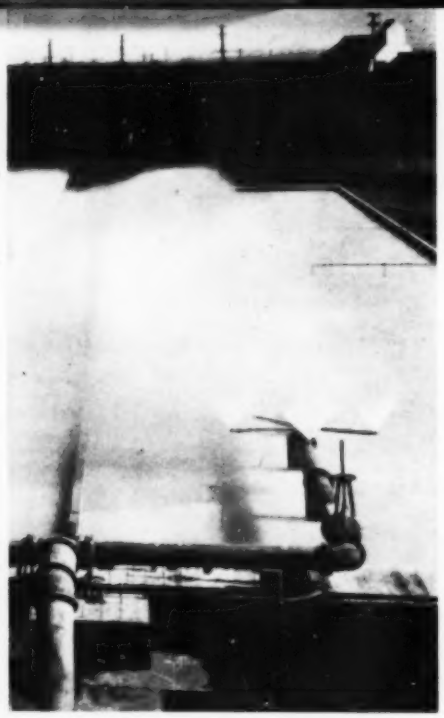
Temperature levels at which this balance is obtained vary with the efficiency of the spray pond. High temperature levels in a poor installation will adversely affect performance of the condenser or other heat transfer equipment. Low temperature levels obtained in a carefully designed, properly operated spray pond will help to maintain high efficiency in the heating portion of the water circulation cycle.

Adequate air circulation and efficient spray nozzles are the principal factors in spray pond design. For high cooling efficiency, a spray nozzle system must bring the largest possible surface area of water droplets into intimate contact with the greatest possible volume of moving air. The arrangement of piping and nozzles should encourage rather than restrict the circulation of air through the sprays. Long, narrow systems with wide air lanes running in the same direction as prevailing winds provide proper circulation without excessive loss of spray through driftage.

Nozzle selection is extremely important. They should be of a type and size which will produce the high, fine sprays required for satisfactory cooling at operating pressures low enough to keep pumping power at a minimum. Most spray ponds are designed for a pressure of about 7 psig at the nozzle. In a typical pond the nozzles are 3 to 4 feet above the water as shown in Fig.1.

Design Requirements

Two basic requirements establish the design cooling capacity. First, the system must dissipate an amount of heat equivalent to that absorbed by the cooling water in condensers or other heat transfer units. Second, the water temperature must be maintained at the level required for



handle a design capacity of 17,000 gpm.

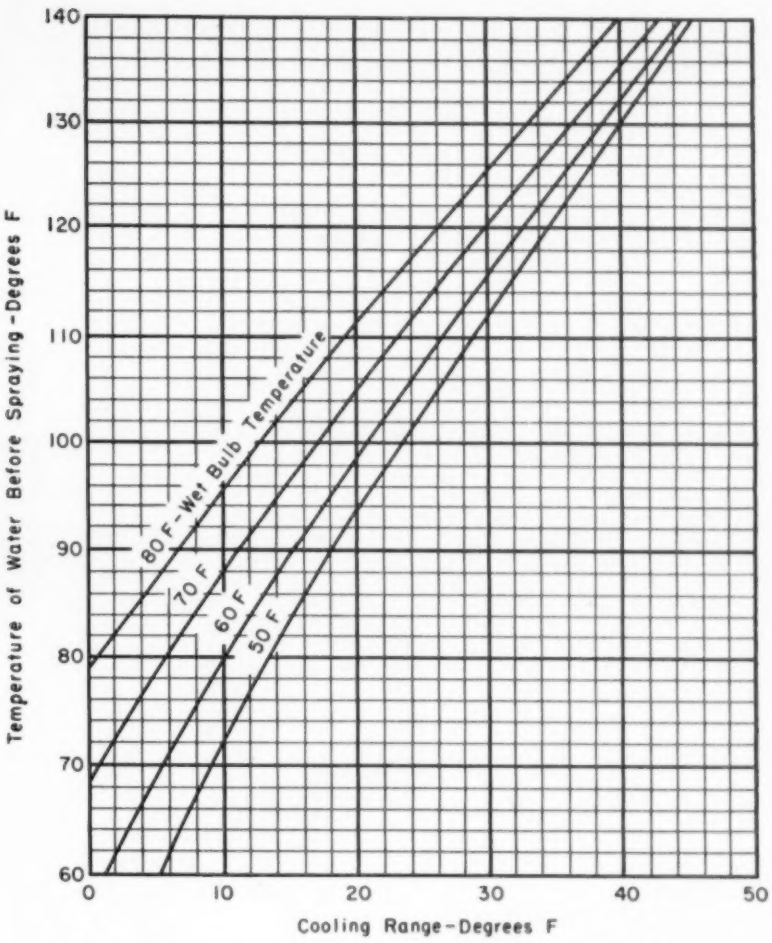


Fig. 2—Cooling range increases as the air wet bulb temperature decreases.

efficient operation of the cooling equipment. The spray nozzle system must produce the degree of cooling that will satisfy these conditions while handling the total quantity of circulating water.

Cooling Range

With a spray system, the degree of cooling which can be attained is limited by the wet bulb temperature of the surrounding air, as a spray efficiency of 100 percent would be required to cool the water down to this value. For most installations, 60 percent spray efficiency is good average performance, although at any specific entering water temperature the cooling range is greater at low wet bulb temperatures than at high wet bulb temperatures. For example, Fig. 2 shows that 120 F water sprayed into air having a 60 F wet bulb can be cooled through a 32 F range to 88 F, which is equivalent to a water-to-steam ratio of about 30 to 1 in the condenser. With the same entering water temperature and 80 F wet bulb, the cooling range would be reduced to 26 F.

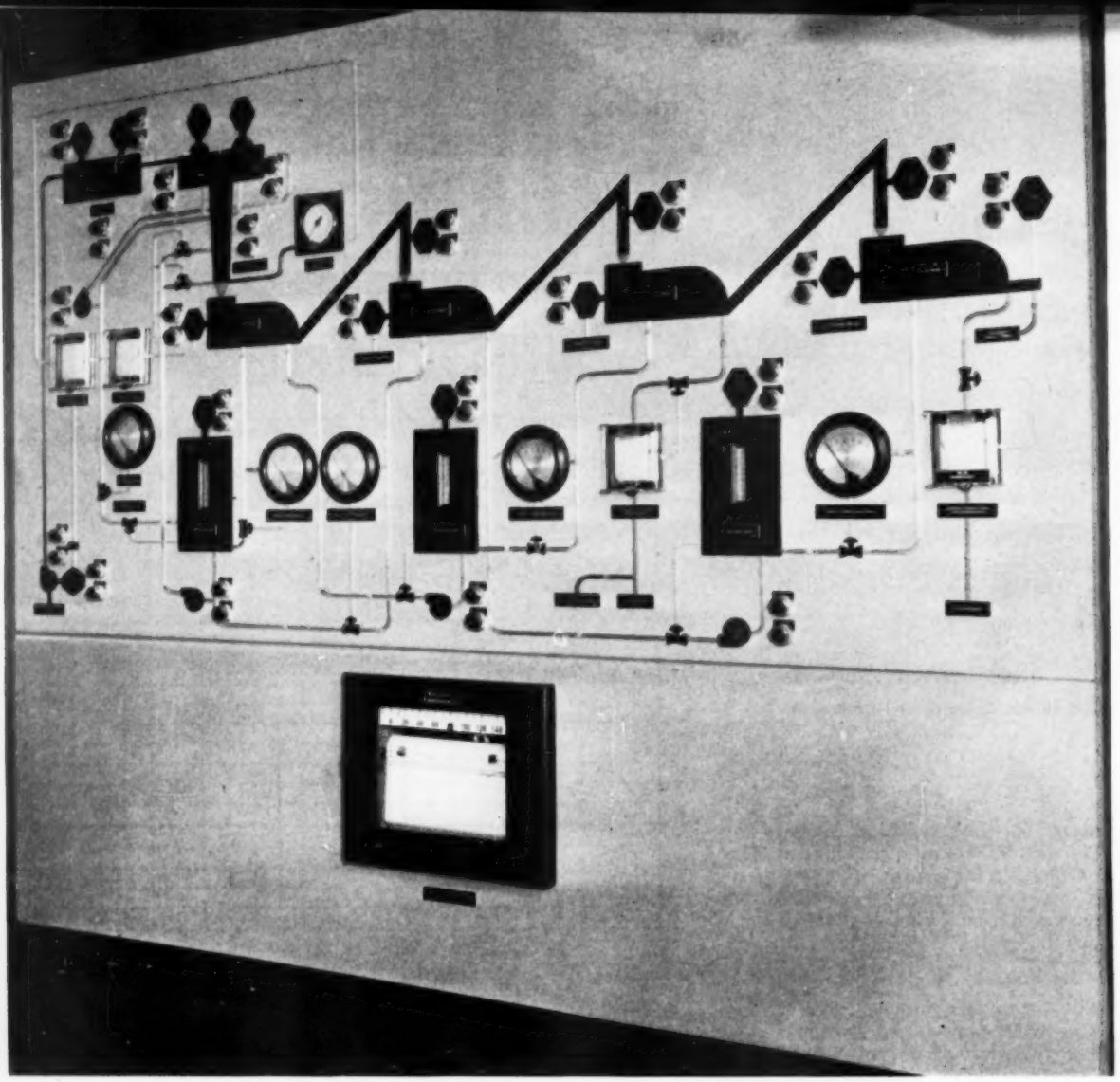
System Arrangements

In general, a spray pond should be designed to provide the required cooling under the most unfavorable atmospheric conditions which can be expected. Thus, the cooling range should be based on the maximum wet bulb temperature prevailing in the locality during a normal summer. Then if the customary single spraying will not provide the desired result, complete cooling may be secured by using a staged arrangement consisting of two independent nozzle systems installed over separate ponds and operated in series. Desired cooling also may be obtained by mixing the warm condenser water with cool pond water before pumping the mixture through a single spray system. However, this method requires a larger nozzle bank to accommodate the increased water volume.

At most plants, the lines for returning the recooled water to the condenser are taken from a suction well in the bottom of the pond. Thus, depending on the area and depth of water in the pond, there is a time lag between the spraying operation and recirculation. This interval equalizes the variations in temperature levels of incoming and outgoing water which are caused by changing atmospheric conditions and produces a more stable cooling range. Many ponds also serve as reservoirs for fire protection, in which case the increased pond capacity contributes to cooling range stability.

Conclusions

When contemplating a new spray cooling system, many details should be investigated. These include: the amount of water to be handled, the water temperature levels required for satisfactory performance of condensers or other heat transfer units, the maximum wet bulb temperature to be expected on an average summer day, the size of ground or roof space available for the nozzle system, and the general direction of prevailing wind over the area. From this information, spray pond equipment manufacturers can design an installation which should meet specific demands efficiently and economically.



The Graphic Panel

Plant facilities are becoming more complex with resulting concentrations of instrumentation in centralized control areas; the graphic panel is helping reduce the resulting complexities by coordinating diverse control functions.

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Industrial Division
Minneapolis-Honeywell Regulator Co.

THE MOST RECENT trend in industrial instrumentation is the increasing use of graphic panels. These involve several variations of the basic idea (by no means new) that indicators, recorders, or controllers should be mounted on a panel in a diagram of the plant operation. Flow lines and equipment—such as pumps and furnaces—are represented schematically by painted lines or raised color strips. Miniature-type instruments are placed in the diagram to indicate their actual points of application.

Components of the instrumentation on such panels may include not only the miniature instruments but also signal lights, push-buttons, pump starters, and other similar operating accessory units—all located on the panel diagram so that their function is instantly recognized by the operator in attendance.

What has led to the greater use of graphic panels in the last several years? The answer to this requires a review of the long-term trend toward centralized instrumentation in industrial plants. Some instrumentation engineers consider graphic panels as only the most recent step in the centralization and improve-

ment of industrial control; like other steps, it is expected to be neither the final nor the complete answer to all control problems.

Development of Centralized Control

Early industrial instrumentation made use of a series of separate instruments scattered throughout the plant--indicating, recording, and sometimes controlling the different variables. Locally mounted control instruments were put near the point of measurement and control. This was ideal for good control because it minimized transmission lags in measurement and control signals. As plants grew in size, however, widely separated locations of instruments prevented operators from gaining any picture of over-all operating conditions at any given time.

The demand thus grew for centralized control rooms where the indicating and recording instruments could be mounted on a single panelboard to provide data for the operator. These instruments were the same size instruments which were previously mounted locally throughout the plant. Measuring some 14 to 18 inches wide, they require considerable panel space. In large, warborn plants, they led to such long and complex boards that they all but defeated centralized control.

Another aspect of the trend toward centralized instrumentation was the problem of lags in measurement and in control signals which it introduced. The development of pneumatic transmission systems permitted remote location of the indicator- or recorder-controller in the control room. In certain applications, even this method caused lags sufficient to require that the control unit be located in the transmitter instead of in the panel-mounted instrument. In order that the controller could be adjusted from the control room, this system required remote manual positioning of the set point from the control panel.

At about this point came an awareness of the need for graphic panels to aid in following the more complex operations. Larger instruments were not easily incorporated in such panels although some earlier graphic panels were designed with them. Smaller instruments were required, but loss of sensitivity, accuracy, readability, or similar qualities was not permissible in the system.

Smaller Instruments

Systems were in use with the control function separated from the indication, recording, and set point adjustments. This led logically to the design of smaller indicators and recorders with separate controllers outside the instrument case. It was reasoned that first, the controlling portion of the system would suffer no loss in accuracy or sensitivity. Second, the controller could be located close to the point of measurement and control where necessary. Third, indication or recording of the variable on a smaller scale or chart need simply provide a trend indication of the variable's behavior rather than a measure of its absolute value. The variable was under automatic control anyway.

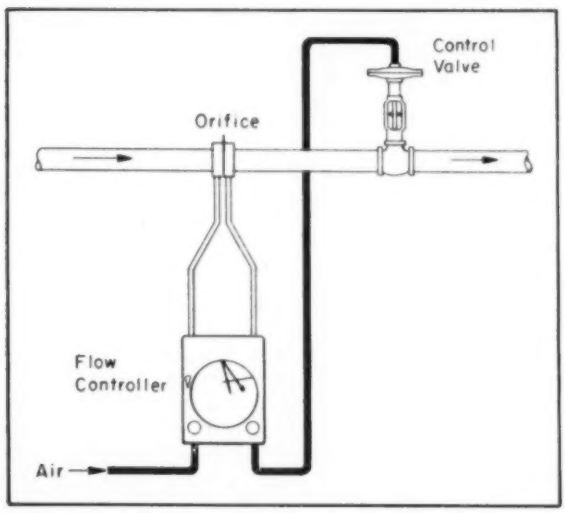
Where more accurate records of the variable were required, it was reasoned that conventional size, multiple-point recorders could be mounted on the sides of the graphic panel outside the flow diagram. Alternately, the narrower ranges on miniature recorders which were made possible by closer control permitted accurate recording of data.

Control Locations

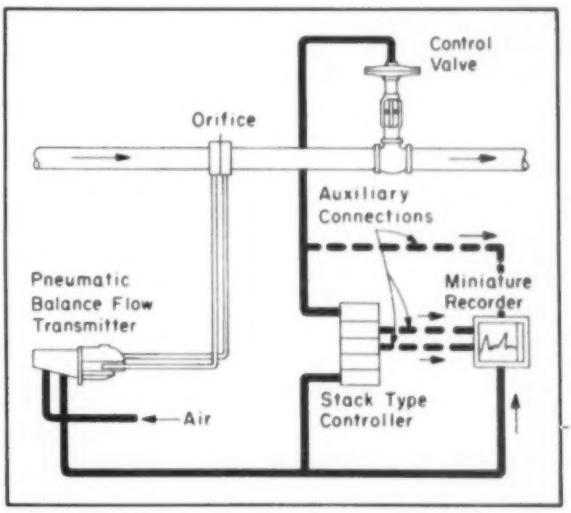
Thus did the present-day miniature indicators and recorders evolve and with them the class of non-indicating "stack-type" pneumatic controllers and transmitters. (The term "stack-type" is applied because the construction is such that a series of cylinders are stacked on top of each other with diaphragms between them.) Systems made up in this way permit location of the control function either at the point of process (often mounted on the control valve) or in the control room (mounted on the rear of the panel or attached directly on the rear of the miniature instrument).

Forms of Graphic Panels

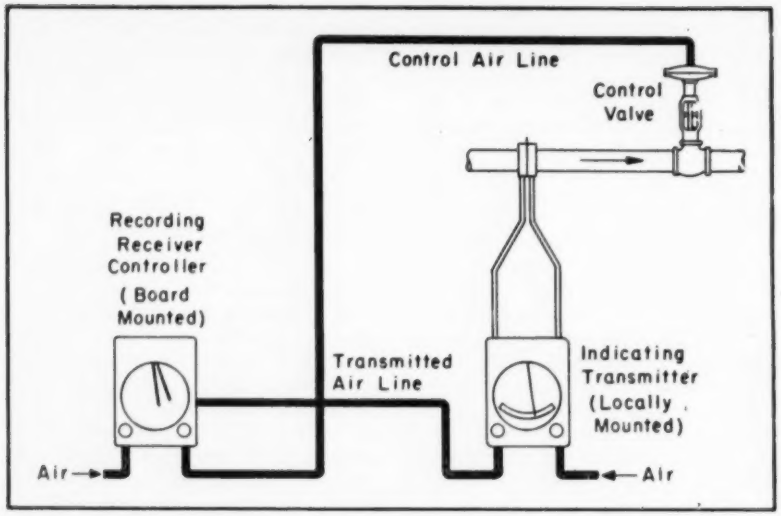
As the graphic panel concept has grown, numerous variations of the basic idea have evolved. Mention was made of the combination of larger multi-point recorders mounted adjacent to a graphic panel for certain key variables. A similar variation is the exclusive use of indicating miniature instruments in the graphic portion of the panel with all desired permanent records provided by adjacent larger recorders. These are sometimes mounted on wings of the panel at an angle to the graphic por-



This locally mounted flow control set-up was adequate when plants were small and systems simple.



Control system for use with graphic panel includes miniature recorder for mounting on the panel.



Recording receiver controller is mounted on graphic panel; panel instrument receives flow information from locally mounted transmitter through air line.

tion to conserve space required for the whole panel installation.

The amount of detail can be varied from almost a complete reproduction of the actual operation to a limited representation showing only the key equipment from an operating viewpoint. Decisions as to detail are based primarily on plant management's desires to provide an operating aid and the complexity of the situation.

Advantages of Graphic Panels

In addition to the obvious advantages associated with centralized instrumentation for today's complex and critical plants, graphic panels have been found to offer several other benefits.

Reduced operator training time is of value in direct proportion to the complexity of the process. Because the graphic panel outlines the operation and its instrumentation, operators and instrument men alike can quickly grasp the inter-relationship of flow lines. They can see at a glance the functions of controls. Some users of graphic panels have found that savings in operator training time alone are sufficient reason for the use of this type panel.

The compactness of the graphic panel, together with its portrayal of process and instrumentation, aids immeasurably in the start-up of a complex operation where the operator must often make adjustments, both to automatic controllers and to manual units. After such adjustments, he can immediately observe the effects on other variables and quickly identify the location of variables affected. Where emergencies arise, these advantages are emphasized; to a lesser degree they apply for normal operation.

Forestalling Difficulties

The operator can frequently foresee operating difficulties and make adjustments to prevent expensive shut-downs because he can visualize and understand the whole operation better. This same advantage applies to plant superintendents and other supervisory personnel whose more detailed knowledge may enable them to spot impending trouble.

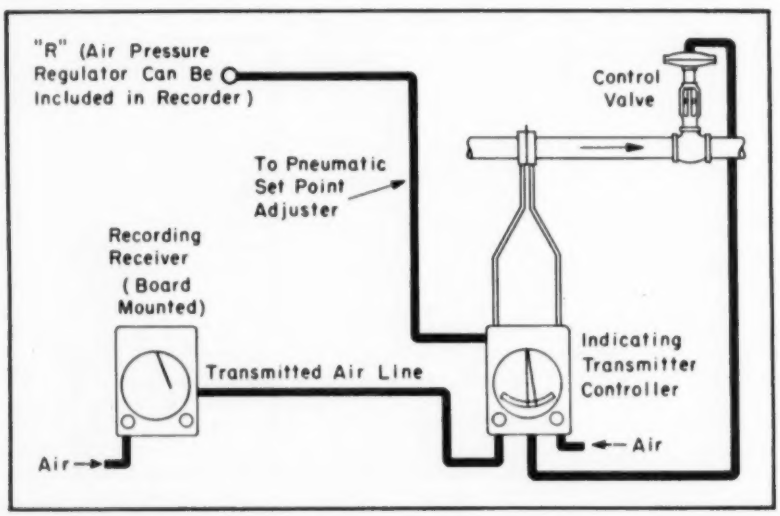
Although dependent on the ratio of complexity to the number of instruments involved, graphic panels considerably reduce the space required for a panel in a centralized control room. In some instances the graphic panel has occupied only half the space required for an equivalent panel using larger instruments.

Limitations of Graphic Panels

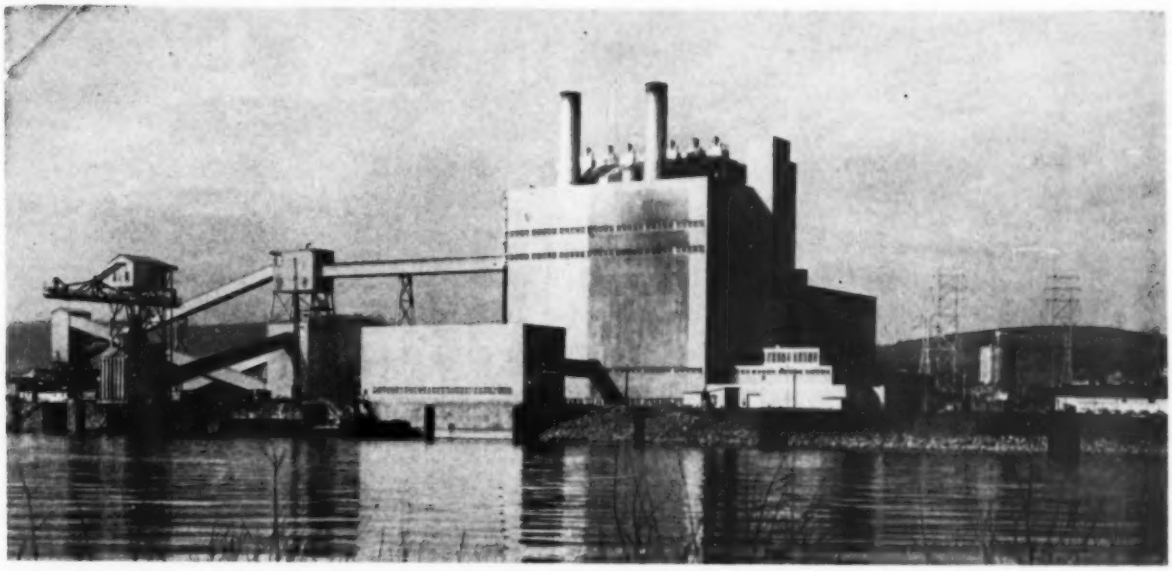
In industrial plants, changes are being made continuously to meet changing product demands, to keep pace with new technology, or to improve efficiency. Such changes require revisions to the panel diagram and changes may be difficult, impossible, expensive, or inconvenient. The use of easily removed raised strips and units for the diagram permit changes to be made more easily and sometimes provision can be made for changes when the panel is designed.

Because the graphic panel concept is rather new and provides an attractive, dramatic appearance, there is a tendency to overlook plant requirements which may not dictate its use. In simpler processes where all control lines are relatively short and no pneumatic transmission of measurements is required, the graphic panel may not be either economical or desirable.

Although the future of instrumentation may lead to newer concepts which will make obsolete the graphic panel as it is known today, there seems little question that it is presently satisfying a very definite need in many industrial plants. On the other hand, it has by no means entirely replaced its predecessor, the so-called "conventional" panelboard.



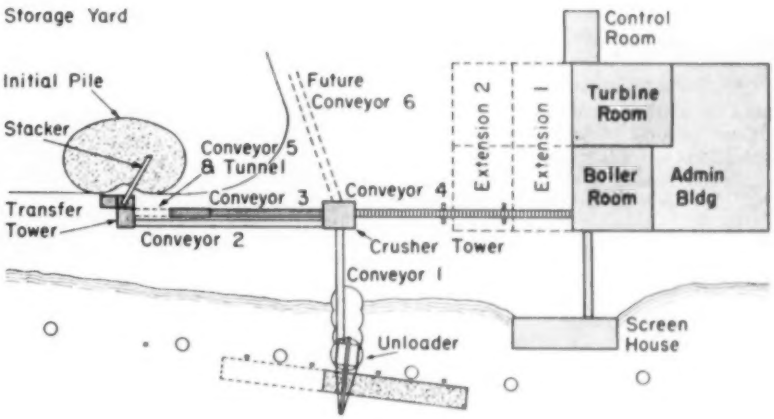
Locally mounted indicating controller and transmitter has its set point adjusted pneumatically from the recorder which is mounted on graphic panel.



Elrama Power Station, built at a cost of $57 million, has already placed two 95,000-kilowatt turbines in operation.

W. B. McLEAN, Engineer
Engineering Works Division
Dravo Corporation

Coal Handling at Elrama



A plan view of Elrama Station showing the coal unloading, handling and storage facilities.

THE NEW ELRAMA Power Station of the Duquesne Light Company, along the Monongahela River near Pittsburgh, has a highly versatile arrangement of conveyors and automatic equipment to unload, store, and move large tonnages of coal used in the operation of its steam power plant.

With this system, coal can be unloaded from river barges, railroad cars, trucks, and carry-alls. Push-button controls enable operators to send coal by conveyor to any desired location throughout the plant.

The essential elements of the coal handling facilities include:

1. A riverside dock for mooring and handling coal barges.

2. A rope-operated, bucket-type tower for unloading coal from barges. The unloading tower includes a surge hopper for receiving coal and smoothing out the flow to the conveyors.

3. A barge haul system, under the control of the unloader operator, for spotting barges.

4. A crusher tower where coal can be crushed to desired size.

5. A transfer tower where incoming coal can be directed either to the storage pile, to the crusher tower, or to the boiler house.

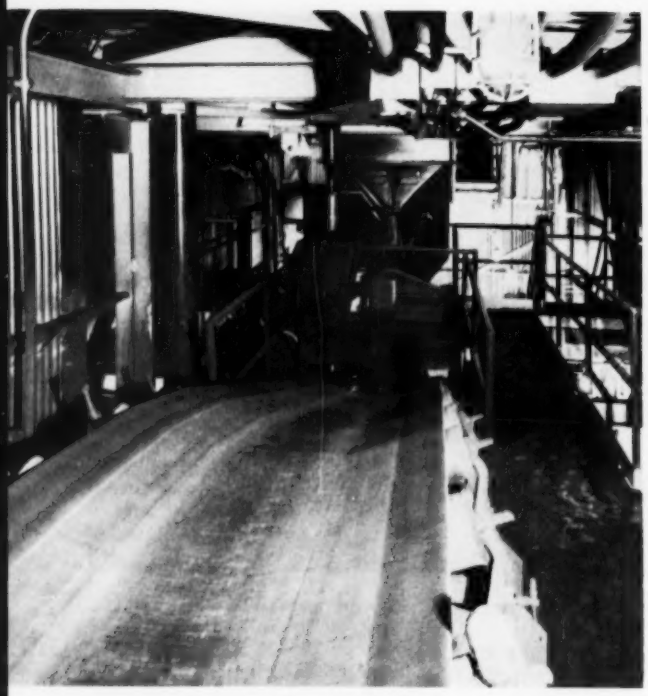
6. A coal stacker for stacking coal in a preliminary pile.

7. A yard hopper for receiving coal brought in by carry-alls, trucks, or railroad cars. The transfer tower, stacker, and yard hopper are combined in a single structure.

8. A coal storage yard with carry-alls and scrapers for distributing coal from the preliminary pile to the yard or reclaiming the coal to the yard hopper.

9. Five conveyors, all in closed galleries and with the necessary feeders. There is also provision for a future sixth conveyor.

10. A traveling tripper in the



Rear end of conveyor No. 4. Coal sampler and parts of dust control system are seen at center of picture.

Interior of conveyor gallery. Push button stations are provided at intervals to stop belt in emergency.

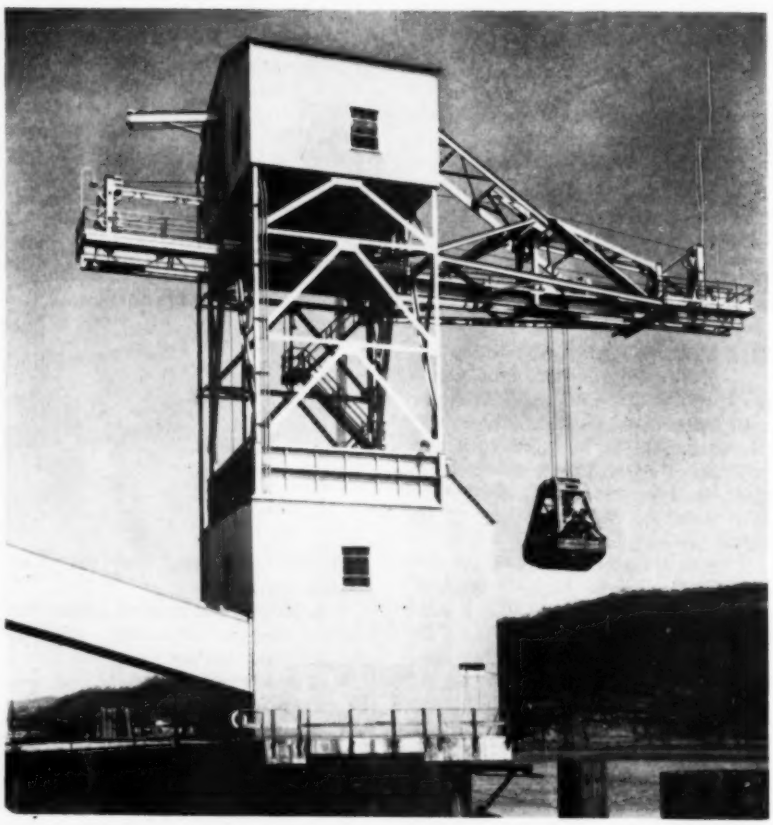
boiler house for diverting the coal.

11. A scale for weighing incoming trucks, a weightometer for weighing coal on the belt when moving, and a sampler for analysis.

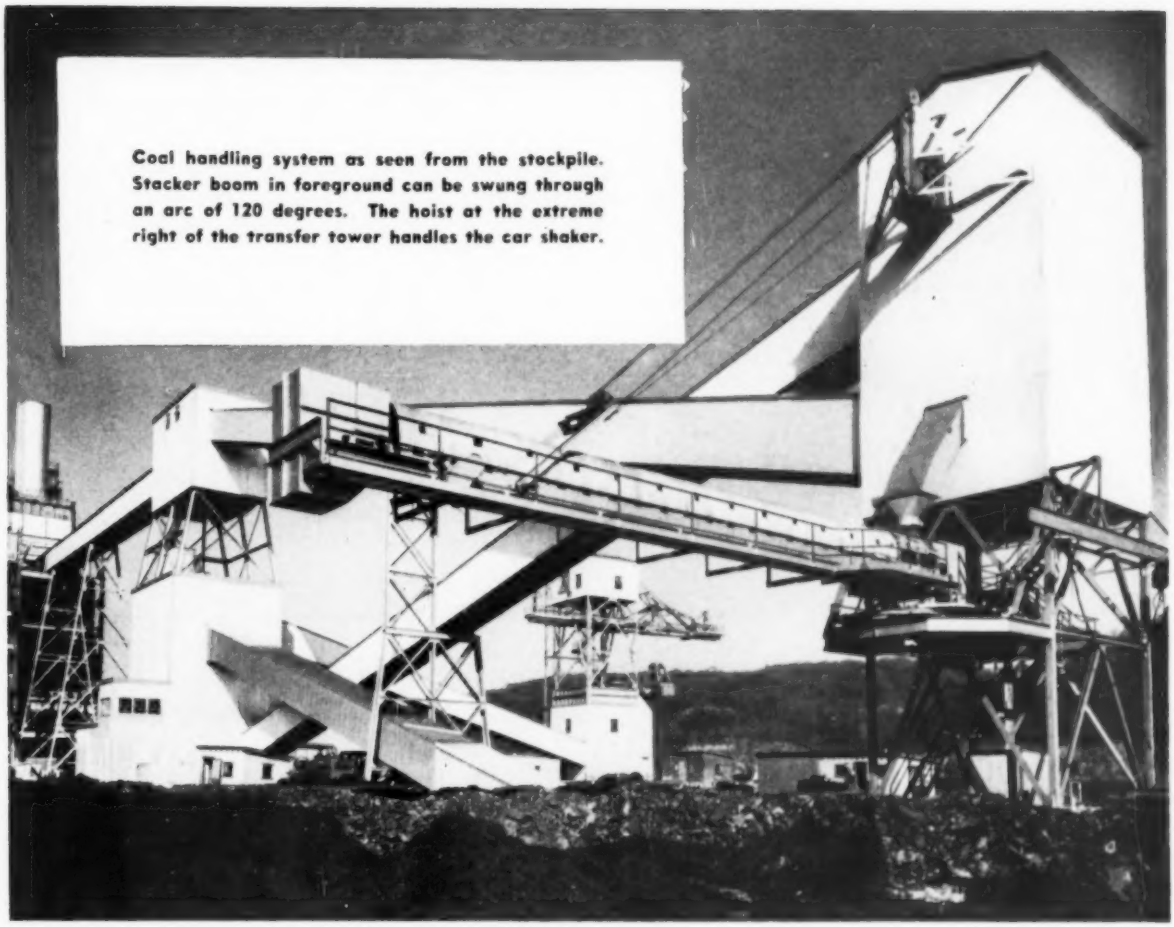
12. A dust collecting system for removal of dust of the crushers.

Coal coming in by river barge is unloaded by the clamshell bucket of the unloader and dropped into the unloader hopper. It is fed by vibrating conveyor onto conveyor No. 1. This conveyor carries it to mid-height of the crusher tower. If the coal is to go directly to the boiler house, it is chuted to the crushers; but if it is to go to the storage pile, it by-passes the crushers. In either case the coal is then fed by vibrating feeder onto conveyor No. 2. Near the lower end of this conveyor it passes over the weightometer and then is carried southward uphill at about 14 degrees to the top of the transfer tower. From there it is chuted either to conveyor No. 3, if destined for the boiler house; or to the stacker, if destined for storage.

Coal coming in by rail or truck, or reclaimed from the storage pile, is dumped into the yard hopper. There, two vibrating feeders place the coal onto conveyor No. 5. Since the top of the yard hopper is at ground level, the hoppers, feeders, and lower end of the conveyor are underground, enclosed in the foun-



The unloader in operation. This is an all-welded, Dravo type unloader with counterweight to balance weight of the bucket and reduce power consumption.



Coal handling system as seen from the stockpile. Stacker boom in foreground can be swung through an arc of 120 degrees. The hoist at the extreme right of the transfer tower handles the car shaker.

dation structure. Conveyor No. 5 travels in a concrete tunnel until it emerges from the ground. This conveyor takes the coal again to mid-height of the crusher tower and dumps it into the same chute as river-shipped coal from conveyor No. 1. It follows the same path as the river-shipped coal—through or around the crushers, over the weightometer, and up conveyor No. 2 to the top of the transfer tower and then either to conveyor No. 3 or to the stacker.

Coal going to the boiler house is carried by conveyor No. 3 northward and uphill on a slope of about 15 degrees to the top of the crusher building. From the upper end of conveyor No. 3, coal is chuted to conveyor No. 4 and at the same time passes the sampler. Conveyor No. 4 is generally level and carries the coal to the boiler house and over the tops of the bunkers where the traveling tripper diverts it.

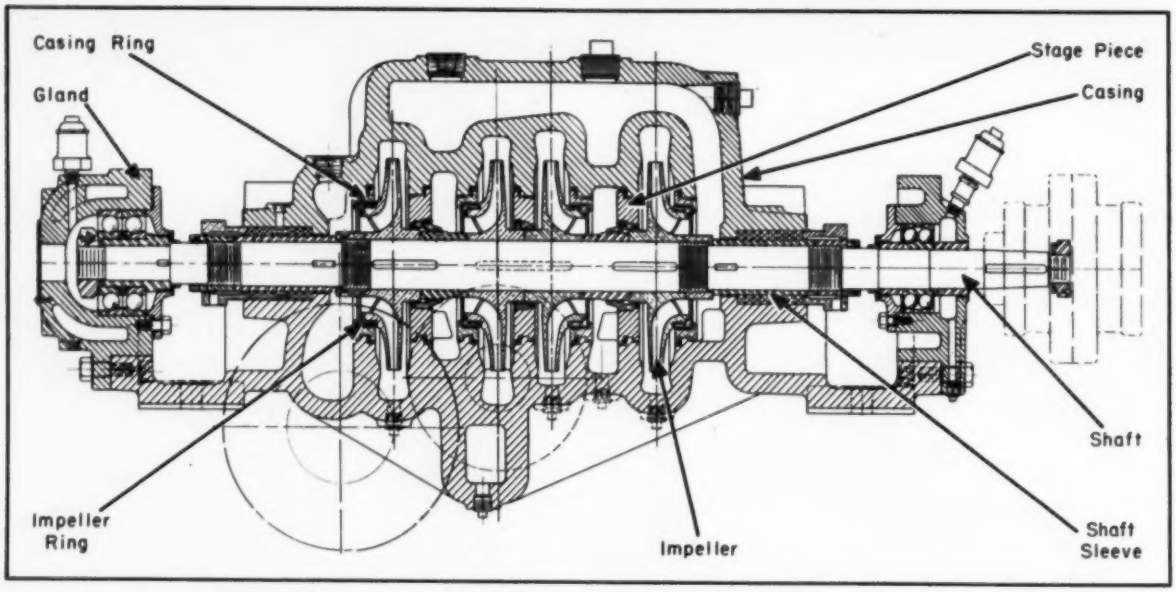
Coal from the unloading hopper is fed to conveyor No. 1 by a vibrating feeder 60 inches wide by 8½ feet long. The feed is approximately at right angles to the conveyor. Coal from the two bottom openings of the yard hopper is fed to conveyor No. 5 by two parallel 48 inch vibrating feeders.

All of the conveyors are 42 inches wide and have a normal capacity of 600 tons per hour. They travel at 410 fpm. All are driven from the upper end through a 36-inch lagged head pulley, except that conveyors Nos. 1 and 5 have a 42 inch lagged magnetic pulley for removing tramp iron. These conveyors carry new coal coming into the plant. Troughing idlers are spaced on 4-foot centers and return idlers on 10-foot centers. Training idlers are used at 50-foot maximum intervals on the loaded side and 100 feet on the return side. At the point of loading, the troughing idlers are spaced more closely.

For conveyors Nos. 1, 2, and 5, which carry lump coal, rubber cushion idlers are used in the loading area. All conveyors have gravity take-ups at their lower end. They also have chain driven rotary rubber belt cleaners on the return side.

The coal stacker has a 42 inch conveyor belt which travels at 455 fpm and has a capacity of 600 tons per hour. Troughing idlers are used at about 5-foot centers and return idlers at about 10-foot centers. Rubber disc troughing idlers are used under the point of loading. The belt is driven from its lower end by a 30-hp motor through a reducer and 36-inch lagged drive pulley. A screw type take-up is provided.

The operation of all feeders and conveyors, and also of the coal stacker, are controlled from a central control on the second floor of the crusher building, located so the operation of the stacker may be observed. In addition, push-button stations are provided at strategic locations for each feeder or conveyor for emergency control at the site. The stopping of any feeder or belt automatically stops, due to interlocking controls, all feeders or belts ahead of the bottleneck to prevent pile up of coal at any point.



Materials used as standard fittings on the pump parts identified above are shown on the table on the facing page.

Centrifugal Pumps . . .

Pump Materials

IGOR J. KARASSIK and ROY CARTER
Worthington Corporation

CENTRIFUGAL PUMPS can be manufactured from almost all of the known common metals or metal alloys as well as from porcelain, glass and even some synthetics. The conditions of service and the nature of the liquid to be handled will determine the most satisfactory materials to be used in the construction. Factors which enter into the selection of these materials are listed as follows:

a. Abrasiveness of suspended solids in the liquid;
b. Corrosive action of fluid;
c. Electrochemical action;
d. Pumping temperature;
e. Head per stage (as it affects both the impeller peripheral velocity and the liquid velocities in the waterways);
f. Operating pressure;
g. Suitability of the material in relation to the structural features of the particular pump involved;
h. Load factor and expected life of the pumping installation.

Pump Casings

Centrifugal pump casings are usually made of cast iron. Cast steel or even forged steel is used when a high discharge pressure or a high pumping temperature, or a combination of both, makes cast iron impractical as casing material.

Bronze is frequently specified when the liquid being pumped is mildly corrosive to iron or steel.

Stainless steel casings are expensive and justified only when handling liquid which is extremely corrosive or abrasive to the metal.

Very special applications may call for porcelain or glass casings.

Impellers

Bronze impellers are preferred when handling water. Bronze has the advantages of being easy to cast when complicated core sections are involved, it is easy to machine to a smooth surface, and it does not rust.

If the liquid being handled is a strong electrolyte, it is not good practice to use bronze impellers with cast iron casings because of corrosion by electrolytic action. It is better to make the impeller of regular or alloy cast iron, cast steel, or even stainless steel.

Because of the higher coefficient of thermal expansion of bronze when compared with that of steel, bronze impellers are seldom used when liquid temperatures exceed 250-270 F. Cast steel or stainless steel is better suited.

Wearing Rings

Wearing rings are generally made of bronze. Cast iron, cast steel, stainless steel, or monel rings are employed when hardness, or other properties not in bronze, are required.

Shafts

Pump shafts, in pumps without shaft sleeves, are commonly made of open hearth steel. Where high stresses occur, preference is given to high tensile strength alloy steels.

Seepage of corrosive liquids through the pores of the impeller hub or through the joint between the impeller and the sleeves may require the use of a non-corrosive metal.

Shaft Sleeves

Shaft sleeves are primarily made of bronze. When bronze is not satis-

MATERIALS FOR PUMP FITTINGS

Parts	Standard Fitted Pump	All Iron Pump	All Bronze Pump
Casing Ring	Bronze	Cast Iron	Bronze
Gland	Bronze	Cast Iron	Bronze
Impeller Ring	Bronze	Cast Iron or Steel	Bronze
Impeller	Bronze	Cast Iron	Bronze
Shaft Sleeve	Bronze	Steel or Stainless	Bronze
Shaft (sleeve)	Steel	Steel	Steel, Bronze or Monel
Shaft (no sleeve)	Stainless or Steel	Stainless or Steel	Bronze or Monel
Casing	Cast Iron	Cast Iron	Bronze
Stage Piece	Cast Iron or Bronze	Cast Iron	Bronze
Diffuser (not shown)	Cast Iron or Bronze	Cast Iron	Bronze

Note: Materials for bearing housings, bearings and other parts are not generally affected by the liquid being handled by the pump.

factory because of its relatively low degree of resistance to abrasion, stainless steel is used.

While a few years ago, steel was favored over stainless steel as a material for shaft sleevings, the growing popularity and reduced cost of the stainless alloys has helped it to replace ordinary steel. In some services such replaced bronze as sleeve material in shafts.

Cast iron is rarely used for shaft sleeves because it cannot be given the necessary smooth finish.

Glands

Glands are generally made of bronze, although cast iron or steel may be used for all-iron fitted pumps. Pumps that handle hydrocarbons have their iron or steel glands bushed with bronze to avoid possible sparking which might ignite inflammable vapors.

Pump Fittings

The expression "pump fittings" may mean two different things. In the most accepted sense, it refers to the general construction features of the pump—as an example, "ball bearing fitted pump"; or to the combination of materials used in the pump, as in "all-iron fitted pump."

In the second interpretation (as when applied in the expression "underwriter fittings"), it may refer to various pieces of auxiliary equipment, such as valves, gages, or even tools used for operating.

Standard Fitted Pump

The so-called "standard fitted" centrifugal pump as defined by the Hydraulic Institute is bronze fitted. It has a cast iron casing, steel shaft, bronze impeller and wearing rings, and bronze shaft sleeves (when the latter are used). Some manufacturers regularly furnish stainless steel shafts on pumps without shaft sleeves as "standard fitted" pumps.

All Bronze Pump

When all parts of a centrifugal pump which come into contact with the liquid being pumped are made of bronze, the pump is called an "all bronze pump." When these parts are made of iron or of ferrous metals, the pump is an "all iron pump."

Acid-Resisting Pump

An acid-resisting pump has all parts of the pump which are in direct contact with the liquid being pumped constructed of materials which will offer the maximum resistance to corrosive action.

Salt Water Pumps

Centrifugal pumps handling salt or sea water can be built with standard fittings, that is cast iron casings and bronze trim. They can also be built in all-iron, in all-bronze, or iron casings and stainless fittings.

Galvanic action between the bronze parts and the cast iron casing causes the casing to graphitize and ultimately to fail. Under high suction lift conditions, galvanic action is accelerated due to the release of oxygen from the water.

An all-iron pump avoids the electrolytic action between bronze parts and cast iron casings. However, a certain amount of iron dissolution may take place leaving graphitized areas. These areas act as cathodes to the untouched anodic parts of cast iron and the resulting galvanic action is self-accelerated.

To avoid the graphitization and poor resistance to cavitation of cast iron impellers, these, along with smaller component parts may be made of stainless steel.

In general, an all bronze pump should give the longest life for sea water conditions. Instances are recorded where all-bronze pumps have lasted over 20 years in sea or harbor water service. There are exceptional cases where harbor water may be contaminated by a chemical which attacks bronze. In these cases a substitute metal must be used.

There are definite limitations for the application of cast iron for pump casings as follows:

1. Where operating pressures may at times exceed original design pressures (either because of operating at higher than design speeds or because of the existence of high suction pressures not anticipated;)
2. When the pumping system is subjected to water hammer or shock pressures beyond normal limits;
3. Pumps handling liquids (such as brine) at very low temperatures, since cast iron loses in tensile strength and becomes quite brittle at low temperatures;
4. At design pressures exceeding 1000-1100 psi and temperatures over 350 F as previously stated.

Temperature Limitations for Bronze

Bronze expands as heated approximately 40 percent more than steel. Since pumps are assembled at normal room temperature, the original radial clearance between the hub of a bronze impeller and a steel shaft will increase under operating conditions if the pumping temperature is above normal. This increased clearance can act to loosen the impeller on the shaft and introduces the possibility of leakage and erosion at these points.

The impeller assembly is held axially by means of shaft nuts or shaft sleeves which themselves are fixed on the shaft by external nuts. If the axial assembly is made tight under cold conditions, the unequal expansion of the impeller hub and of the shaft will cause "crushing" of the bronze impeller hub and may even set up severe stresses in the shaft itself. If the assembly is made so that it is tight under operating temperature conditions, the impeller will be loose at low temperatures and there is no possible provision that can be made to hold it in ac-

curate axial alignment until the pump becomes heated.

Finally, if there are changes in the operating temperature, it would be impossible to keep the assembly tight at all temperatures without setting up excessive stresses.

These difficulties are resolved when the pump fittings are of the same material and the expansion of the shaft, impellers, and sleeves is equal. For this reason, bronze is generally not used for pump fittings whenever the temperature of the pumped liquid exceeds 250 F.

Peripheral Speed Limitation

The centrifugal stress exerted on an impeller and the resulting stretch at the impeller hub may become quite appreciable at the higher peripheral speeds used in modern high head pumps. As an example, a typical 12 in. impeller mounted on a 3 in. shaft and operating at 3600 rpm will have a stretch of approximately 0.0011 in. for bronze or cast iron. If, in addition to this, the pump handles hot water—say at 250 F—and the impeller is made of bronze, there will be an additional temperature expansion difference of 0.0014 in. The total looseness of 0.0025 in. would be excessive for good operation.

To avoid the cumulative effects of excessive thermal and centrifugal expansion, the empirical limit to the application of bronze impellers in pumps handling hot liquids is a peripheral speed of approximately 160 feet per second, or a head of 375 feet per stage, whichever governs.

The pH Factor

The pH value of a liquid is a quantitative representation of the relative acidity or alkalinity, and the pH of a given solution varies somewhat with temperature changes, decreasing rather rapidly up to 300 F and remaining fairly constant above that. For instance, a solution with a pH of 8.5 at 70 F will have a pH of about 7.0 at 300 F and 6.8 at 500 F.

Standard bronze fitted pumps should not be used for pH values below 6.0 or above 8.5 at the pumping temperature. Below 6.0, all bronze pumps or stainless steel fitted pumps should be used. Above 8.5, the pumps should be all iron or stainless steel fitted materials.

Galvanic Corrosion

Galvanic corrosion is the rapid corrosion of metal which occurs when two dissimilar metals are connected with each other and both are immersed in an electrolytic solution. This is the simplest form of an electric battery cell. The electrochemical reaction set up under these conditions causes electric current and small metal particles to flow from one metal to the other. These particles may become deposited on the second metal or else be washed away, due to the flow velocities in a centrifugal pump. The protected metal is the cathode and the corroded end is the anode.

If metals are arranged in the order of their relative tendency to corrode through galvanic action, the resulting tabulation is a "galvanic series."

The galvanic series will give an approximate idea of the interrelation of metals most commonly used will not include the various stainless steels used for pump parts as the position of these alloys in the series cannot be definitely fixed and has been known to change depending on the exact nature of the electrolytes. They will occupy a position in the iron and chrome iron group. The galvanic action between these materials is almost negligible.

Structural Features

Structural features of a given pump part may play a definite role in the final material selection. As examples: A part requiring extremely thin wall sections cannot be made of cast iron; shaft sleeves must be made of metals that are capable of receiving a high degree of polish; when pump impellers have to be shrunk fit, bronze cannot be used.

Type of Service

The type of service in which the pump will be used helps dictate the ultimate choice of materials. Economy must be weighed against such factors as dependability, continuous or intermittent use, a temporary or a permanent installation. Usually, a compromise is effected between the cost and the quality of the materials.

An example of applications where reliability is of the utmost consideration are the centrifugal pumps used by the U. S. Navy in shipboard operations. Many of the pumps on board ship operate relatively infrequently in peacetime. All the equipment is rarely operated constantly even in wartime. However, the Navy enforces the most rigid specifications as regards materials, since failure of any part of the equipment may prove disastrous. The same considerations apply to pumps used on fire service where dependability is, again, of paramount importance.

Metallurgical Advances

There are two fields in which metallurgical advances have had a marked effect on the design of centrifugal pumps. One field is in the pumping of chemicals. Because each chemical, however, poses its own specinc pump material applications problem, it does not lend itself to a general discussion.

The second field is that of boiler feed pumps. Most boiler feed pumps designed for pressures of 800 psi and above are now stainless steel fitted, regardless of temperature or feedwater analysis. The application of stainless steel fittings, that is impellers, wearing rings, sleeves, show signs of extending to even lower pressures. Today, it is almost mandatory under all pressure conditions for temperatures over 250 F and for all installations where the feedwater pH is either below 7.0 or over 8.5.

Recent developments indicate that in addition to the use of stainless steels for the internal parts of centrifugal boiler feed pumps, stainless steel casings will be utilized to a much greater extent. A definite impetus in this direction has been given by the findings of an investigation conducted by the Boiler Auxiliary Sub-Committe of the Prime Movers Committee of the Edison Electric Institute. This investigation was initiated to determine the cause of the rapid pump deterioration being experienced in many of the high pressure power plants, a condition which had reached alarming proportions in the early forties. Among the various findings made by the Sub-Committee was the fact that stainless steels, 13 percent chromium and better, are immune to the attack of any boiler feedwater so far encountered. The 5 percent molybdenum steel is apparently also immune.

The possible range of selection of corrosion-resistant stainless steels is wide and includes both the straight chromium steels and the so-called austenitic, chromium-nickel steels. In the former type, the chromium content may be at the 5, 9, or 13 percent level. In the latter case, the composition range may extend from the familiar 18 percent chromium, 8 percent nickel type to the higher 25 percent chromium, 20 percent nickel type (adopted by the U. S. Navy for all boiler feed pump service). The final selection depends on design and operating conditions.

The austenitic steels have a coefficient of expansion approaching that of bronze and 50 percent greater than that of carbon steel or of the lower chromium level steels. If the design of the boiler feed pump is such that this difference in coefficient of expansion may lead to operational difficulties, the use of 18-8 steel is not recommended.

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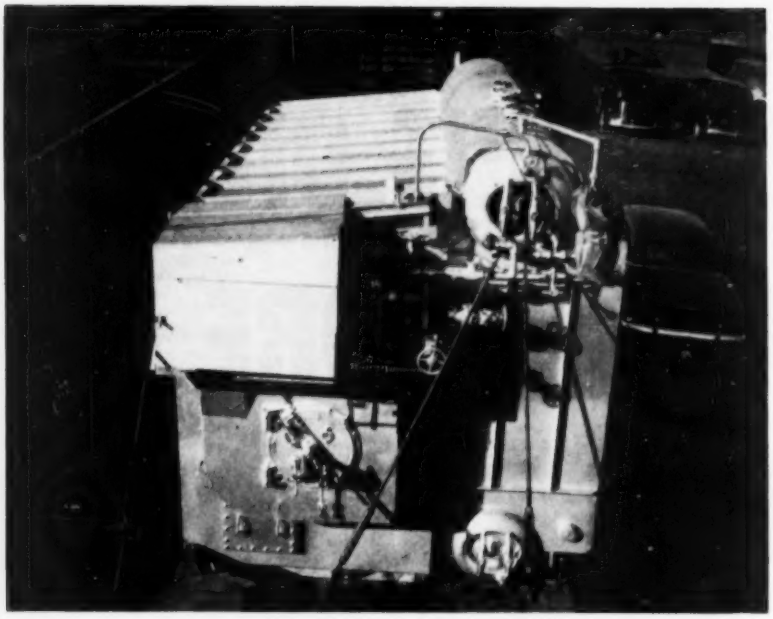

Factory assembled boilers greatly reduce the time required for installation.

New Water Tube Package Boiler

Beats Predicted Performance

VIGGO MARCUSSEN, Plant Engineer
Stocker Manufacturing Co.

REPORTS from the Stocker Manufacturing Company at Netcong, New Jersey provide one excellent example of the utility of standardized steam generators. During the early part of 1953, this company was faced with the necessity of obtaining facilities to meet process and heating steam demands. Since available space was limited, the multiple advantages of a factory-assembled design were apparent. Thus, a water tube package boiler was installed.

This installation is the first application of Combustion Engineering's new type VP boiler, which utilizes the long established, two drum, vertical bent tube arrangement with a water cooled furnace in front of the convection surface. The new unit features a higher ratio of furnace wall cooling to furnace volume than any other boiler of comparable size and type. This design assures rapid, efficient heat absorption with lower gas temperatures entering the convection bank. It also results in less slag formation and aids in minimizing furnace maintenance.

The unit is guaranteed to generate 20,000 lb of saturated steam per hr continuously at 80.5 percent efficiency. Pressure parts are designed for 250-psig pressure, and the boiler normally operates at a working pressure of 225 psig. Feedwater temperature ranges from 200 to 272 F. Internal treatment is employed to limit the concentration in the boiler to a design value of 3500 ppm.

Although the boiler is designed for pressure firing of oil or gas either alone or in combination, the fuel at Stocker Manufacturing is No. 6 oil with a heating value of 18,500 Btu per lb. An oil pump and heater set, furnished as standard equipment with the boiler, assures continuous, controlled oil flow to a steam assisted, mechanical atomizing burner. The oil pressure at the burner averages 100 to 150 psig, and oil temperature approximates 200 F. If gas firing becomes desirable in the future, a ring type gas burner can be added to the present air register.

A centrifugal forced draft fan provides the necessary primary air for combustion. This type of unit operates more quietly than the typical high speed blowers furnished with many steam generators. Since the fan supplies air to the furnace at a pressure high enough to overcome the total draft loss through the unit, no high stack or induced draft fan is required. Omission of the induced draft fan reduces the noise level of the plant and eliminates the maintenance this unit would require.

Complete auxiliary equipment including a water column, feedwater valve, feedwater regulator, blowdown valves, chemical supply lines, and other standard boiler accessories were mounted on the unit prior to shipment. An automatic combustion control system also was supplied which maintains constant steam pressure. This system adjusts air flow and fuel feed in the proper proportion to meet fluctuating load demands. In addition, safety devices provide protection from flame failure, excessively high steam pressure, and low water level.

Since the boiler was completely assembled including the setting and casing, only a few days were required to mount it and complete the necessary service connections. After the unit was placed in service, tests were conducted to determine how closely the actual operating results compared with predicted performance. During these tests, the boiler carried a maximum capacity of 21,500 lb per hr. Indications are that there was considerable reserve in the boiler above this rating if additional fan capacity had been available.

Results of the tests indicate: (a) efficiency exceeded expectations throughout the entire load range, (b) boiler exit gas temperatures were almost the same as predicted, and (c) boiler draft loss was approximately as anticipated. It was also noted that carryover at full load was less than ½ ppm at boiler concentrations of 3500 ppm.

Stocker Manufacturing finds this new design, water tube package boiler is extremely satisfactory. Performance has far exceeded expectations and maintenance has been negligible. Although the unit has not been in service very long, it appears both of these considerations will be sustained with normal operating procedures. In addition, the fact that gas firing can be readily added offers definite advantages.

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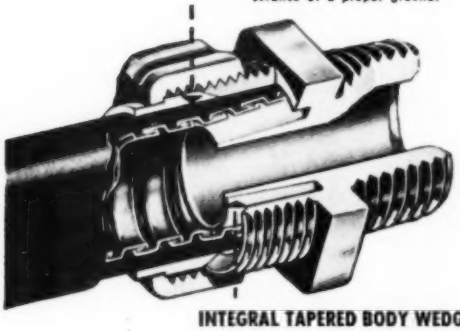

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- Grounding member integral with body.

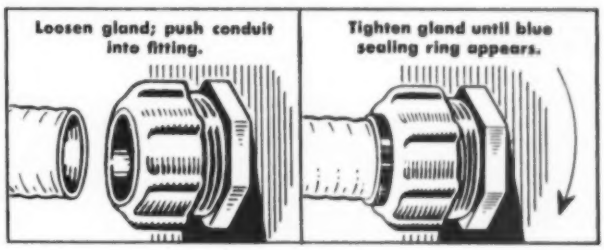
Seal out all moisture, oil, and corrosive fluids with this easy-to-install, self-grounding connector . . . a connector specially designed by T&B for Types UA and EF (J.I.C. Standard) liquid-tight flexible metal conduit.

Just push conduit into connector body and take up on gland nut until blue plastic ring appears. No need to disassemble connector. No twisting of conduit. Same wrench fits both body and gland.

Integral tapered body wedge positively grounds metal conduit armor. Plastic-to-plastic seal between gripping ring and conduit jacket makes tight leak-proof connection. Straight connectors, 45° and 90° elbows available for conduit from ⅜" to 2".

Send for sample and engineering data today.

A CINCH TO INSTALL—



LOOK FOR THIS SIGN — ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T328

THE THOMAS & BETTS CO.

INCORPORATED

86 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P. Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

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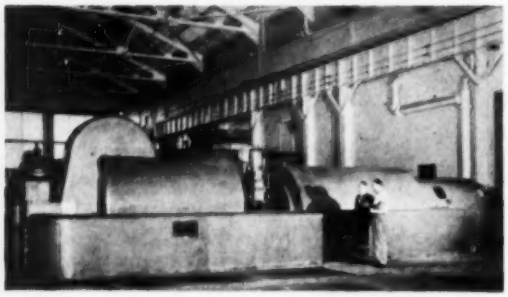
spot news

. . . what's happening in U. S. industrial plants



Power Plant Modernization Completed

Output of power has been greatly increased and smoke and fly ash reduced to a minimum with completion of the final unit in an $8 million power plant modernization program of the Goodyear Tire & Rubber Co. at Akron, Ohio.

This Plant 2 project combines a completely revamped section of the company's former power plant with a new and larger unit constituting an over-all structure five stories high.

Equipment is fully automatic; recording instruments supply detailed permanent accounts of equipment performance.

Most of the smoke and 94 percent of the fly ash is removed from the boiler gases before they go up the plant's stacks. A pneumatic ash handling system, incorporating a jet exhaust device, sucks the ash and soot residue into covered conveyors. This waste material is then blown into a silo and trucked away. Outgoing air from the exhaust is water-washed for purification.

In addition to supplying ample steam for factory processing, the two Babcock and Wilcox water-tube boilers also power an Allis-Chalmers turbine which generates 12,500 kw. These boilers replace 12 grate-type units previously used.

Zeolite water-softening tanks with a capacity of 700 gal per minute reduce water hardness to one part per million.

Efficiency has been increased about 11 percent with the new installation. Savings effected are expected to enable the plant to pay for itself within a relatively short time.

Demonstration Tool Shows Advantages of Planned Relamping

To expose the hidden costs of "spot relamping" and emphasize the benefits to be had from planned group relamping, General Electric's Lamp Division has developed a demonstration tool called the "G-E Lamp Burnout Visualizer."

The Visualizer consists of three parts: a perforated paper envelope; a four-page telescoping insert; and a four-page explanatory folder. The 100 punched holes in the envelope represent 100 percent of the lamps in any lighting installation. Sliding the insert back and forth reveals black spots representing the number of burnouts to be expected at various stages of average lamp life.

According to the Visualizer, replacing 100 burnouts one at a time takes 33 hours of a maintenance man's time and probably an equal number of hours of lost production time; labor costs may be such as to make it advisable to put in new lamps in all sockets at 20 percent of burnouts.

A five-point relamping program is proposed: (1) check present lighting, (2) employ group relamping, instead of spot relamping, to enjoy mass production benefits, (3) save the cleanest, brightest 20 percent of lamps for spares, (4) replace burnouts from these spares, (5) when all spare lamps have been used, commence next relamping cycle.

For further information on lighting maintenance, see page 93 of November INDUSTRY AND POWER.

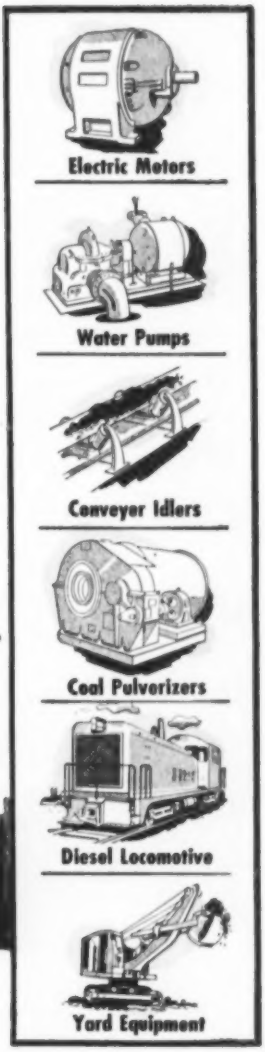
Driver-Led Electric Trucks Approved for Semi-Hazardous Areas

Savings in cost, space, time, and man-hours can be effected in those industrial processes heretofore unable to use driver-led electric trucks because of semi-hazardous conditions according to John A. Baldinger, general manager of Automatic Transportation Co.

Underwriters' Laboratories has awarded its EE rating to the Transporter, Transtacker, and Transtractor models made by this company. The Type EE classification has been adopted by the National Fire Protection Association for material handling operation in semi-hazardous areas. The association's rigid specifications are the basis for fire insurance policies throughout the country.

All models bearing this designation will carry an Underwriters' label and serial number, in addition to

"Indianapolis Power & Light Company's large new White River plant uses Shell Alvania Grease on every one of these grease applications!"



Check the multiple qualities of this remarkable lubricant

Shell Alvania Grease is effecting important improvements in plant maintenance and purchasing practice. In plant after plant, this one grease is replacing the many special purpose greases formerly used . . . for *every grease application in the plant!*

Look at these advantages:

1. Shell Alvania Grease flows *freely* in cold temperatures, yet will not run out of bearings under excessive heat.

2. Ideal for wet, humid applications . . . it resists water emulsification.

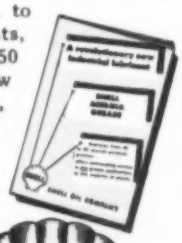
3. Shell Alvania Grease has extremely high oxidation stability.

4. You'll find that Shell Alvania Grease extends time between greasings . . . a substantial saving in labor and grease.

5. Simple inventory . . . just the one grease to stock and apply.

• • •

The economy of handling just one grease instead of *many* is an established fact. Write for the new booklet on Shell Alvania Grease . . . to Industrial Lubricants, Shell Oil Company, 50 West 50th Street, New York 20, N. Y.—or, 100 Bush Street, San Francisco 6, Calif.



SHELL ALVANIA GREASE

The True Multi-Purpose Industrial Grease

SHELL

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HE'S A V.I.P.

(Very Important Person)

HE'S A C.P.S

(Centrifugal Pump Specialist)

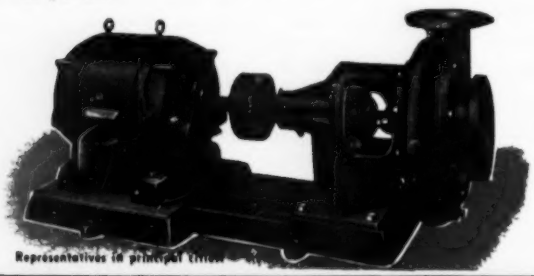
Both of these men can further your career!

The C.P.S....Centrifugal Pump Specialist, from WEINMAN, is a V.I.P. in your life if you are responsible for the operation of pumps in your plant.

This fellow knows how to cut your pump costs. In fact, he's a specialist who can take the pressure off of you when it's caused by liquid handling problems. He will help you work out any pumping problem, whether it's application, installation or replacement, and free you for other plant problems.

You can depend on the advice and service of a WEINMAN Centrifugal Pump Specialist. He's devoted his entire career to WEINMAN Pumps He knows pump design and can recommend the right type for your special needs.

To get to know this V.I.P. in your life, write, wire or phone.



Built by Centrifugal Specialists

The WEINMAN Pump Mfg. Co.

286 SPRUCE STREET • COLUMBUS 8 OHIO

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spot news

—Starts on page 88

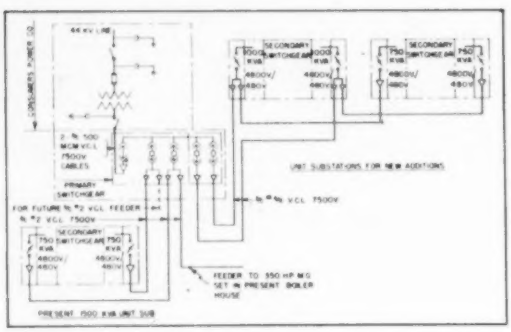
Automatic's own serial number. This label service signifies that all models carrying the labels are subject to inspection by Underwriters' engineers at any time during construction. They will also be inspected by fire insurance inspectors during service, to see that they are maintained according to proper standards.

High-Voltage Test Equipment Is Mounted in Service Car

High-voltage test equipment, in increasing demand by electric utilities and industrial plants for proof tests and cable-fault location, has been mounted in a car for complete mobility.

The unit, available on a rental basis, is furnished complete with an operator and is capable of 100 kv dc at 100 milliampere rectified full-wave for high-voltage d-c testing, and has a 20 kv pulse generator for determining fault location.

Inquiries concerning service should be sent to General Electric Wire and Cable Dept., Bridgeport 2, Conn.



Permanent Magnet Plant Uses Selective Distribution System

Dependability and flexibility were stressed in the design of the power distribution system used in the new Edmore, Mich., permanent magnet plant of the Carboloy Department of General Electric Co.

The plant itself not only is located to take advantage of a second power source in the north-central Michigan area, but also makes use of a selective distribution system to reduce possible extended power interruption.

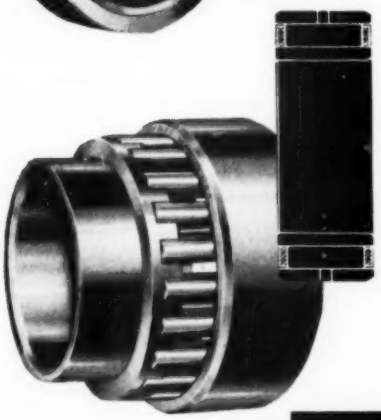
All power for the plant is purchased from a private source and brought into the plant at 44,000 v.

The 5000 kva transformer located on plant property steps down the voltage from 44,000 to 4800 v. The power then is brought into a primary switchhouse through two cables, each of which could carry the plant in an emergency. From the switchhouse, the power is distributed through magnablast breakers to the various double-ended load center units located, as close as possible, to centers of load throughout the plant.

Both the magnablast breakers in the primary

HY-LOAD

High-capacity, cylindrical roller bearings for heaviest radial loads and light or intermittent thrust loads. Produced in 3 diameter series, 2 widths and more than 800 sizes.



INDUSTRIAL INCH

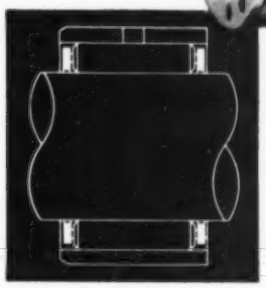
Designed for slow-moving, heavily loaded machinery where large-diameter shafts are the rule. Accordingly, it is available in fractional-size bores for shafts from 4" in diameter upwards.

WOUND ROLLER

This is a three-part separable bearing available in various width classifications. The roller construction provides maximum resistance to shock, abrasion and fatigue.

BARREL

A series of angular-contact, self-aligning bearings capable of sustaining both radial and thrust loads. Race and roller curvatures insure ideal distribution of load, not only for normal operation but also for conditions of misalignment.



TRUNNIONED ROLLER

Ideal for industrial trucks, textile machinery, gear pumps, conveyors, hoists and agricultural equipment. Rollers have trunnioned ends which fit into holes in the end rings. End rings are located and held parallel by spacing bars which also guide and retain rollers.

DESIGNED FOR HEAVY DUTY...

HYATT ROLLER BEARINGS

...and there's a type and size for every need

Hyatt's complete line of radial and angular-contact bearings—*more than 800 sizes in the Hy-Load series alone*—makes the engineers' job easier, because it makes possible greater design flexibility. For the equipment *buyer*, this means longer bearing life and lower maintenance costs—with just the right bearings designed into every vital load-carrying position.

The next time you buy new equipment, or make a changeover, *specify lower maintenance costs by specifying Hyatt Bearings!* And if you need technical help in your selection of bearings, or desire information about particular bearings or their applications, ask for the services of a Hyatt sales-engineer. Call or write Hyatt Bearings Division, General Motors Corp., Harrison, N. J.

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION

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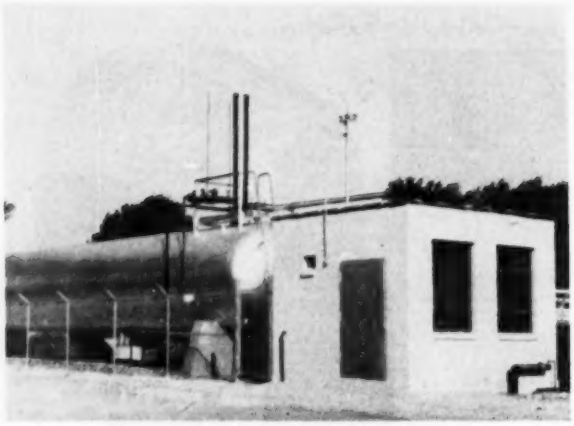


Peacock-built plant at New London, Wisconsin

Only Peacock offers you a

Custom-Built

PROPANE-AIR GAS
or
ANHYDROUS AMMONIA PLANT

. . . based on 20 years of specialized experience

More than 80 PEACOCK plants now in operation are proving that custom-built PEACOCK plants can offer you *three big advantages* over so-called "package" plants. PEACOCK plants are

- ***Simpler to Operate***
- ***More Economical***
- ***Trouble-Free***

FREE ILLUSTRATED BOOKLETS . . .
Write today for illustrated literature describing advantages of Anhydrous Ammonia Bulk Plants and Propane Stand-by Plants.

PEACOCK CORPORATION
PAUL E. PEACOCK, JR., *President*
WESTFIELD, NEW JERSEY

"There's no substitute for experience"

Circle 546 on Reply Card for more data

spot news

—*Starts on page 88*

switchhouse, and the feeder breakers in each load center unit are of the draw-out type which permit maintenance without power interruption.

There are also four types of direct current conversion equipment: one 600 kw, 240-v double-ended ignitron rectifier load center unit, fifteen 12 kw, 6-v, 2000 amp plating rectifiers, one 250 kw motor generator set, and various sizes of selenium rectifiers rated at 125 v dc.

Ignitron rectifiers were selected as the primary source of direct current power because the compact load-center unit-type construction requires less space and can be installed quickly, easily, and inexpensively.

Electric Heaters Are Mounted on Presses

Sheet metal workers are kept warm right at their shearing job by means of Chromalox electric radiant comfort heaters at a Middle West steel warehouse. Five compact heating units, mounted on the presses, focus gentle heat on hands and feet of three operators.

Operating cost of the electric heating method is less than the cost of run-of-mine coal and scrap wood used in salamanders for the same purpose according to the company. With the radiant heaters, heat is aimed at the exact spot where it's needed.

The heaters are manufactured by Edwin L. Wiegand Co., Pittsburgh, Pa.

Magnet Carrier Gathers Scrap Automatically

One carload of metal chips and shavings is collected daily, without attendants, by means of an automatic magnet-carrying system engineered and built by the Cleveland Tramrail Division of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

The scrap comes from metal-working machines on the first floor and is emptied through chutes into two parallel tunnels in the ground below. Each tunnel has its own overhead track on which a carrier travels back and

(Continued on page 116)

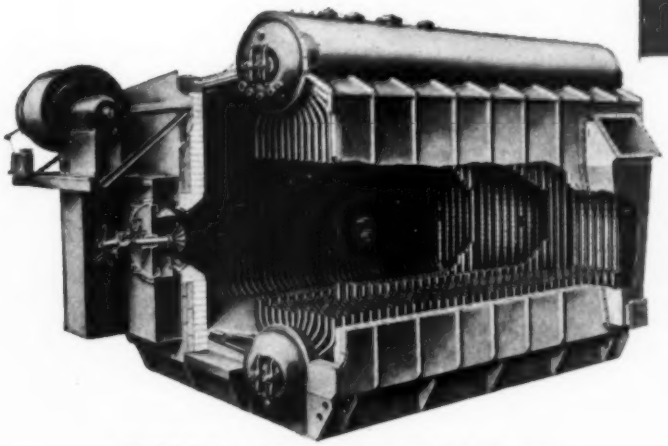
FOR STEAM CAPACITY up to 60,000 POUNDS

Choose your boiler from these two

If you burn oil or gas, investigate the VP Package Boiler for capacities up to 30,000 pounds per hr . . . the VU-10 up to 60,000 pounds.

For stoker firing, the VU-10 is available from 10,000 to 60,000 pounds of steam per hour.

Whatever your fuel . . . whatever your steam capacity requirements up to 60,000 pounds per hour — you'll find that one of the Combustion Engineering Boilers described below will be just right for you.



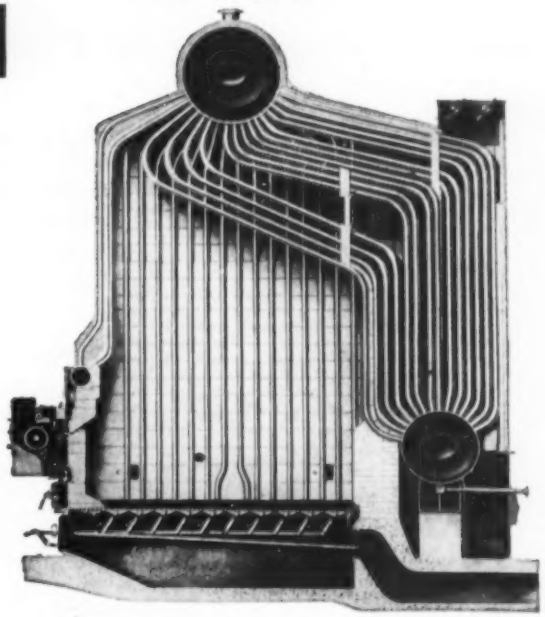
The VP Boiler — the Package Boiler with EXTRA Features

THE VP BOILER

The C-E Package Boiler, type VP . . . completely shop-assembled . . . for oil or gas firing. It is available in capacities from 4,000 to 30,000 lb steam per hr; for pressures to 250 psi. The VP Boiler has more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. The large (30-in. diameter) lower drum permits a simple, symmetrical tube arrangement . . . greater water storage capacity . . . easy access for washing down or inspection. The centrifugal fan is efficient, yet its noise level is less than half that of typical high-speed blowers used on most package boilers. Baffle arrangement is simple, resulting in low draft loss . . . simple soot blowing . . . elimination of dead pockets . . . high heat absorption.

THE VU-10 BOILER

The VU-10 Boiler is designed for industrial load conditions, particularly for plants with small operating and maintenance forces. Capacities range from 10,000 to 60,000 lb steam per hr . . . pressures to 475 psi . . . heat recovery equipment is available if desired. Fuel can be either coal (C-E Spreader, Traveling Grate or Underfeed Stoker) oil or gas. This boiler is a completely standarized design adaptable to many conditions. It responds readily to variations in load; it is simple to operate and maintain. All parts are easily accessible for inspection. Like the VP, the VU-10 Boiler is a complete unit — boiler, furnace setting, fuel-burning equipment, controls, forced draft — bringing you the benefit of one contract . . . one guarantee . . . one responsibility.



The VU-10 Boiler, as arranged for C-E Spreader Stoker firing

COMBUSTION ENGINEERING, Inc.

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

B-689B

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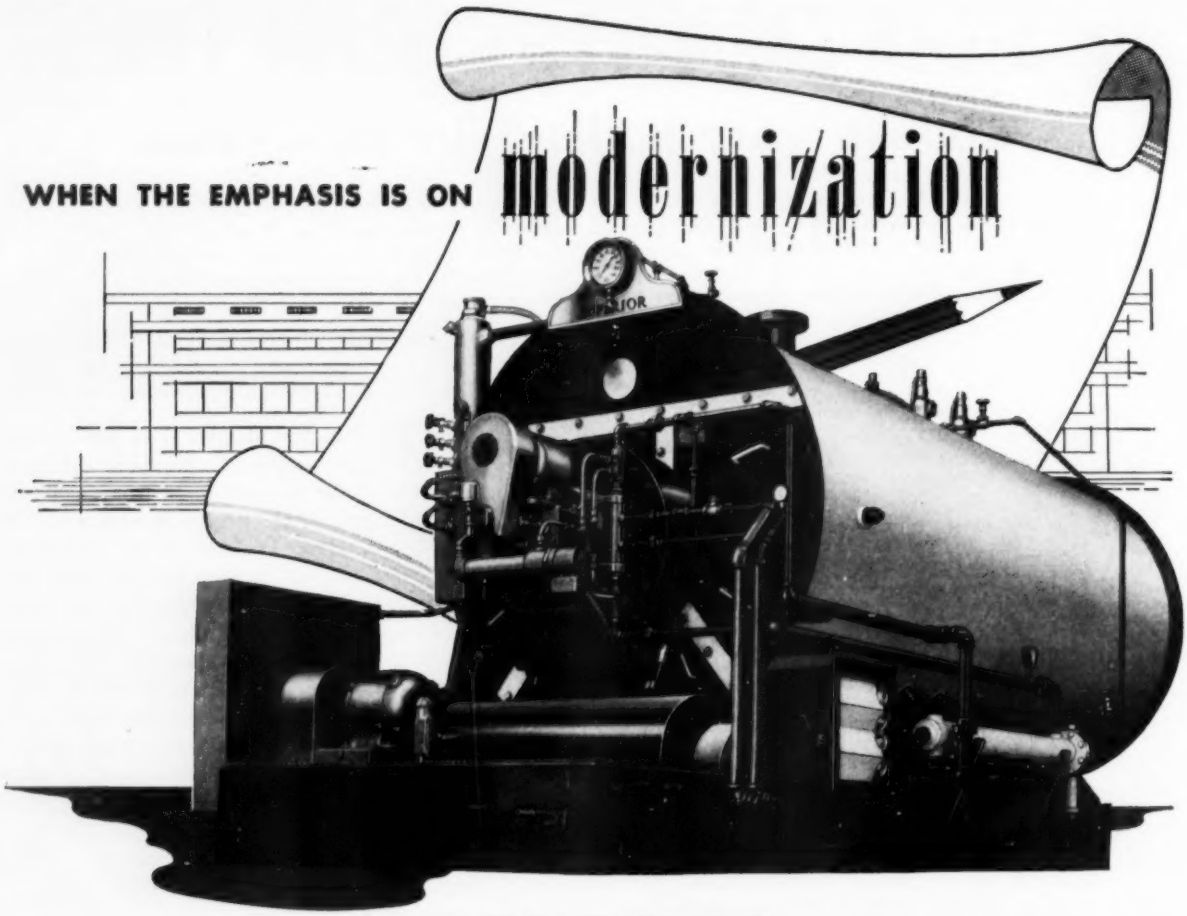
WHEN THE EMPHASIS IS ON **modernization**



CUT STEAM COSTS WITH SUPERIOR STEAM GENERATORS

LET'S FACE IT!

Fuel, labor and maintenance are the big elements of steam cost. They completely overshadow original cost of equipment. Fuel costs are higher, wages are climbing . . . and surveys show that 2 out of 3 boilers are obsolete . . . while competition in almost every field is keener. If you are looking for opportunities to cut operating costs, talk with a Superior engineer. Write for Catalog 502.

Complete, compact, and efficient, SUPERIOR Steam Generators are the easiest and quickest means to boiler room modernization. Shipped complete after factory tests which guarantee more than 80% thermal efficiency, SUPERIOR Steam Generators are designed for long-run economy, and backed by undivided responsibility.

Installation is simplified for speed and economy . . . requiring no special foundation, no expensive chimney other than a vent for exhaust gases . . . puts steam where used, eliminating long steam lines. Compact design saves space and construction costs.

Fully automatic operation with any grade of oil or gas assures maximum fuel economy with minimum supervision. Ample heating surface (min. 5 sq. ft. per b.h.p.) assures operation at capacity without overfiring. Built-in induced draft makes boiler rooms cleaner, quieter, and safer.

Modernize with a modern SUPERIOR Steam Generator.

for performance you can **BANK** *on*

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N. Y.

SUPERIOR STEAM GENERATORS

Circle 548 on Reply Card for more data

Con Edison specifies "K" Monel pump shafts for New Astoria Station

At their first all-new plant in 25 years, the Consolidated Edison Company means to take no chances with pump shaft trouble.

The Astoria Station, now under construction at the edge of New York's East River, has four single-stage vertical mixed flow pumps (each with a capacity of 68,500 gpm) to circulate water for its condensers. Made by Economy Pump Division of H. C. Wheeler Manufacturing Company, *all four pumps have "K" Monel shafts, as specified by Con Edison engineers.*

They singled out this rugged shafting material for several important reasons. For one thing, they knew "K" Monel offered them excellent resistance to corrosion. This was a basic need, for water drawn from the brackish, sewage-polluted East River is highly corrosive.

They wanted, too, a shaft metal that had great strength and hardness, and high resistance to corrosion fatigue.

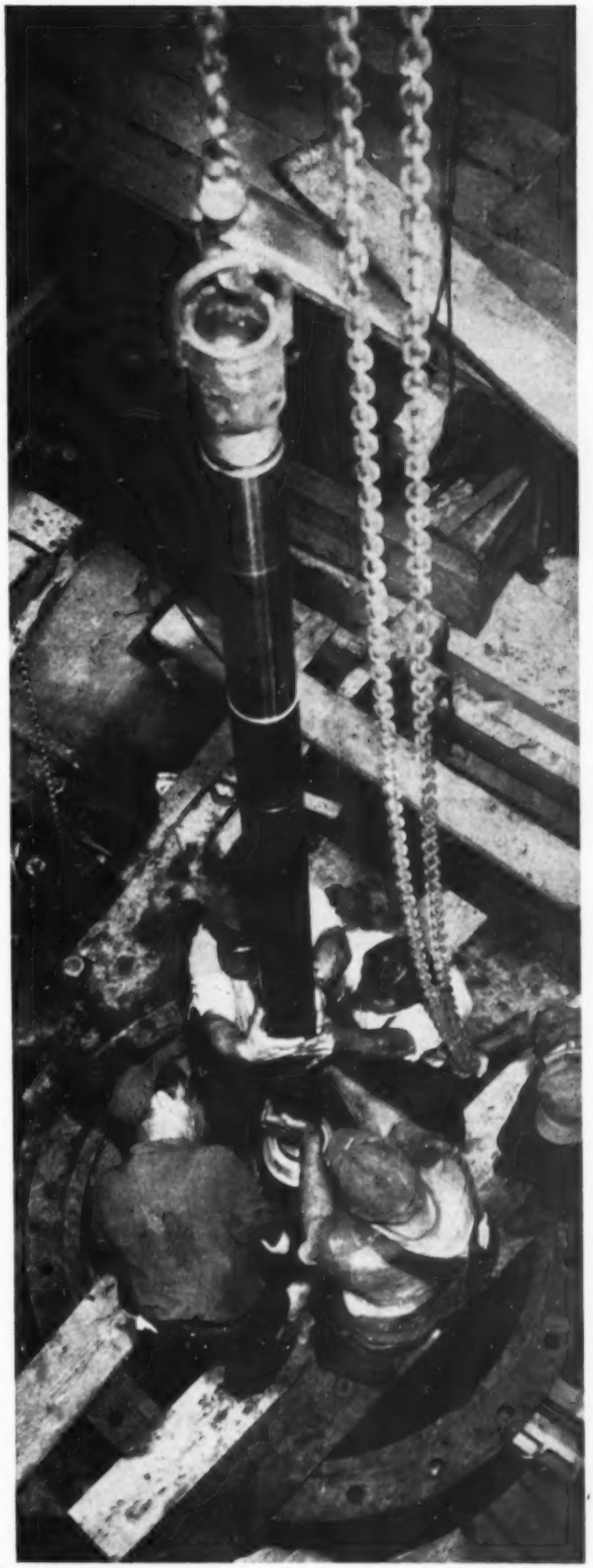
"K" Monel meets all these requirements. And it has the additional advantage of being heat-treatable *after* machining without undue distortion.

There's valuable information for pump users in our booklet, "*How to get longer service from your pumps.*" A copy belongs on the desk of every man concerned with the operation, maintenance or purchase of pumping equipment. The booklet will be sent promptly — without cost or obligation. Write for it — *today*.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

Inco Nickel Alloys INCO

MONEL® • "R"® MONEL • "K"® MONEL
"KR"® MONEL • "S"® MONEL • INCONEL®
INCONEL "X"® • INCONEL "W"® • INCOLOY®
NIMONIC® Alloys • NICKEL • LOW CARBON NICKEL
DURANICKEL®

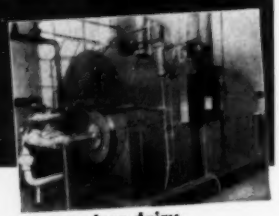


One of four. Workmen lower a "K" Monel shaft into a giant SAFV Wheeler-Economy pump at Con Edison's new station in Astoria, N. Y. This shaft is 6 inches in diameter, 27½ feet long, and weighs 1,900 pounds. It has a minimum Brinell hardness of 265. In operation, the pump, with a total dynamic head of 16 feet, will be driven at 233 rpm by a 400-hp motor.

Circle 549 on Reply Card for more data

Dutton EconoTHERM EARNS OWNER PRAISE

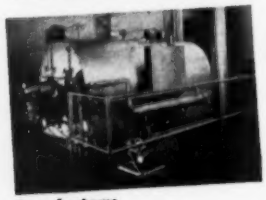
in a railroad roundhouse



in a modern dairy

in a food processing plant

in a hospital



in a factory

in an institution

in a concrete plant

in a municipal waterworks

AND HERE'S WHY!

Verbally and by mail* owners have enthusiastically reported big savings in fuel, labor and space — often all three — thanks to EconoTHERM's efficient Off-center Firing, Rotary Combustion and Automatic Operation.

EconoTHERM gives quick steam with greater safety . . . saves fuel, labor and maintenance expense. Gas or oil fired, sizes are available to 250 H.P.

Get all the facts on the Dutton EconoTHERM's compact, modern packaged design and automatic operating features. See how it can satisfy your steam needs and save *you* money!

*Ask to see the letters!

Write for EconoTherm Bulletin EC-52B

CHECK FIRST with Dutton

Dutton BOILERS

DIVISION HAPMAN-DUTTON COMPANY

KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

FOUR TYPES SIZES FROM 5 TO 250 H.P.

Circle 550 on Reply Card for more data

readers' guide

. . . an index to advertised products

The table below lists, according to product groupings, all equipment advertised in this issue. To request more data, circle key numbers on Reply Cards, pages 34-35 & 94-95

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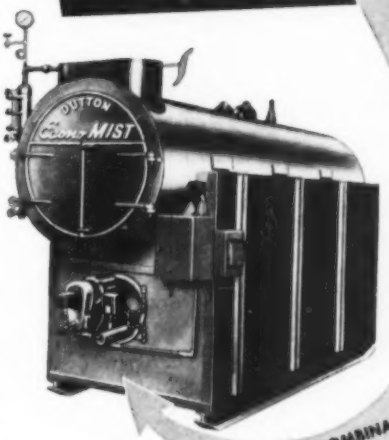
CUT STEAM COSTS with MULTIPLE CONVERTIBLE FIRING!



GAS
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GAS-OIL
GAS-COAL
OIL-COAL
CORN HUSKS
WOOD CHIPS
OTHER FUELS
AND COMBINATIONS

...all handled by this PACKAGED AUTOMATIC

Dutton EconoMIST

YOU GAIN BIG, cost-cutting advantages when you install an EconoMist! Delivered in a "package", it's ready for service connections—soon ready to give you quick steam *automatically.*

AND NOTE the *partial* list of fuels you can use—singly or in many combinations—as any *one* offers you the greatest saving. You can equip to fire with waste by-products when they're available—or use gas, coal or oil . . . part or full-time!

WITH ANY FUEL, the EconoMist gives you the *tremendous reliability* and *long, long service life* of simple H.R.T. design.

BE SURE you learn all the ways this Dutton EconoMist can cut your steam costs. . .

WRITE TODAY FOR ECONOMIST BULLETIN EM-528

CHECK FIRST with Dutton BOILERS
FOUR TYPES SIZES FROM 5 TO 250 H.P.
DIVISION HAPMAN-DUTTON COMPANY
KALAMAZOO, MICHIGAN • BOILER BUILDERS SINCE 1880

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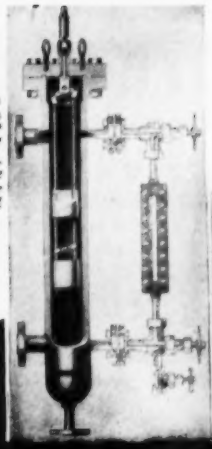

Jerguson Water Column with 7-HP Gage and A-37 Drain Valve. Available complete, or as individual units.

JERGUSON WATER COLUMNS Give Positive Alarm Signals

Keen Knife-Edge Balance Holds Key To Outstanding Jerguson Performance

YOU'RE sure of positive boiler alarms with JERGUSON WATER COLUMNS . . . because keen *knife-edge balance* assures immediate action.

Positive action is necessary when boiler water level falls too low or rises too high in your boiler. Jerguson's camshaft arrangement exerts sufficient force to give the power to assure action under all conditions. The warning whistle blows *immediately* when the limit is reached in either direction.

The alarm mechanism on JERGUSON WATER COLUMNS is stainless steel throughout. Valve stem, cam, and knife edges are carefully hardened. A complete range of pressures and sizes, with screwed, flanged, or welding connections. There's a dependable JERGUSON WATER COLUMN to fit your requirements. ***Write for Data Unit***

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Gages and Valves for the Observation of Liquids and Levels

JERGUSON GAGE & VALVE COMPANY

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Offices in Major Cities

Jerguson Tress Gage & Valve Co., Ltd., London, Eng.
Pétrole Service, Paris, France

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bulletins

. . . for other bulletins just received see page 39

AIR FILTERS & DUST COLLECTORS

229—Industrial Dusts

"The Collection and Recovery of Industrial Dusts," 32-page manual 101, discusses various types of dust and techniques used in analysis, lists the factors which influence choice of equipment, and explains the operation of each type of collector. Buell Engineering Co., Inc.

230—Dust Collectors

Series of four folders describes cyclone type collector and portable, standard, and automatic bag-type dust arrestors. Also includes 32-page catalog describing exhaust fans for dust collecting and air handling. Northern Blower Co.

BOILERS & BOILER ACCESSORIES

231—Spreader Stokers

Spreader stokers said to be adaptable to all types and makes of modern steam boilers and generators, from 5000 to 75,000 lb per hr steam output capacity, are described in 14-page brochure 800. Various installations using Roto-Stoker Type CC stokers of these capacities are highlighted by means of cross-sectional drawings and photographs. Detroit Stoker Company.

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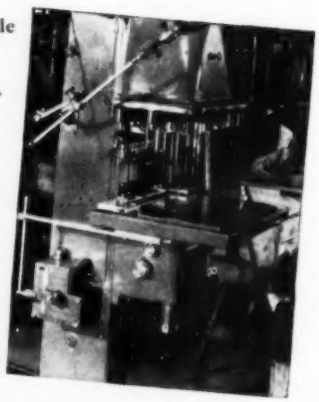
Now PULSOLATOR is made and sold by Manzel

Manzel has added the world-famed *Pulsolator* to its established line of Force Feed Lubricators and Chemical Feeders. Thus, this 55 year old organization now offers low pressure, single pump lubrication for applications where the unlimited pressure of Manzel force feed, individual pump systems is not required.



Here's a typical application showing how *Pulsolator* automatic, loop systems are used for lubricating machine tools, printing presses and comparable equipment. As many as 1,000 bearings can be lubricated by one system from a loop line of up to 300 feet. Capacities, timing, and quantity of lubricant delivered can be adapted to individual requirements. Manzel engineers will be glad to plan a system to meet your exact needs either on new machines you are planning or on existing equipment.

Manzel

See us at Booth 1247
Plant Maintenance Show

DIVISION OF FRONTIER INDUSTRIES
320 BABCOCK STREET, BUFFALO 10, NEW YORK

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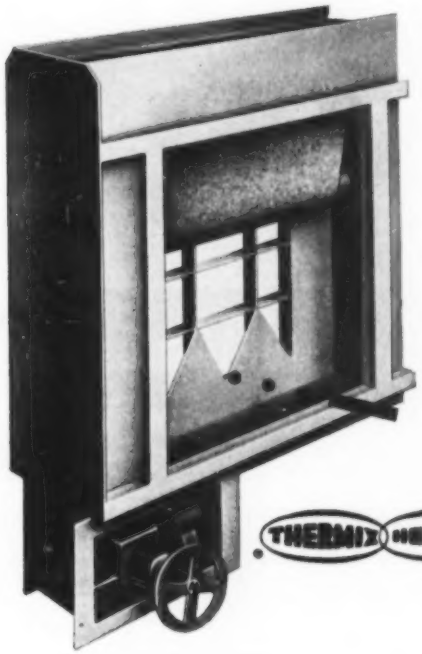
Only a Heacon Damper offers you this



"V"

The V that gives you accurate control in the lower flow increments

Heacon Dampers provide the only solution to accurate flow control. With a background of over a decade of application to specialized problems, Heacon Dampers are accepted by engineers as the only means of accurate flow control, particularly in the lower flow increments.

V-porting is the secret. Heacon Dampers may be designed with V-porting to produce practically any flow characteristic from zero to 100%. With conventional dampers barely cracked, a flow of 10 to 20% or more is immediately released with resultant flow control problems in the entire system.

Heacon Dampers are a radical departure from normal damper construction. Consisting of supporting grill, sealing strip and flexible curtain of woven blue asbestos, metal or other suitable material as determined by the application, Heacon Dampers are recommended for use where these two factors, among others, are of major importance:

1.—Accurate control and ease of operation by either manual or mechanical means.

2.—Positive, tight seal when damper is closed.

The Thermix Corp., Project Engineers for Heacon Dampers are specialists in the application of this damper to your particular requirements. Why not call their engineers today.

Project Engineers

THE THERMIX CORPORATION

GREENWICH, CONN.

(OFFICES IN 38 PRINCIPAL CITIES)

Canadian Affiliates: T. C. Chown, Ltd. 1440 St. Catherine St. W., Montreal 25, Quebec. 983 Bay St., Toronto 5, Ontario, Canada

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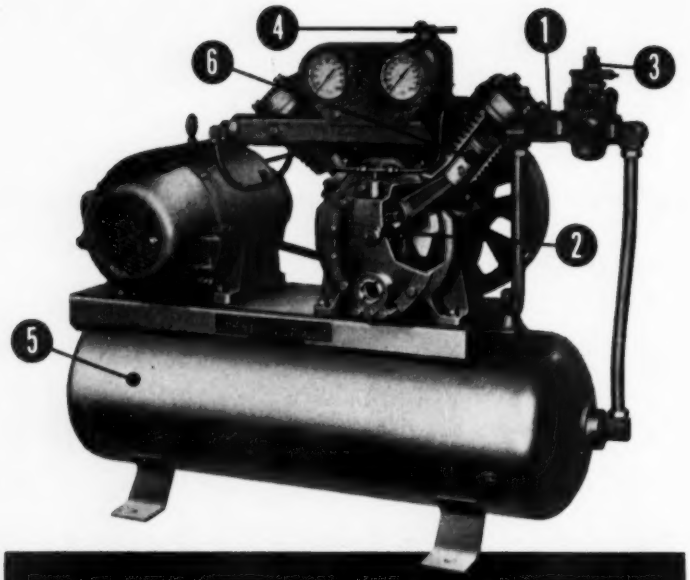

Transfers ALL The Ammonia Liquid - Gas You Pay For

The use of the Ingersoll-Rand LPG Compressor is the most efficient means known for the transfer of Anhydrous Ammonia. Specially designed for this operation, you can now transfer *every drop* of liquid ammonia and recover *practically all the gas too!*

These important features make it possible to repay quickly your original cost by the gas you recover:

1 Quick Unloading

Designed for 250 lbs. maximum intake pressure, the LPG Compressor requires no throttling of intake pressure. Result is greater "free gas" capacity.

2 Totally Enclosed Centrifugal Unloader

Compressor automatically unloads when stopped. Unit never starts against load after being stopped regardless of reason for stopping.

3 Four-Way Reversing Valve

A simple turn of the handle reverses the phases of operation.

4 Simplified Oil Filling Device

Oil can be added to the crankcase with no escape of gas. Specially designed oil filler pot and check valve also eliminate need for hand operation of valves.

5 Large Scrubber Tank

Prevents slugs of liquid from entering the compressor. Take-off to the compressor is located at highest point of tank.

6 Low Oil Consumption

Four-ring piston construction combined with a unique breather system keeps oil consumption to a minimum.

Write today for complete details of this economical profit-recovering system

865-3

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N.Y.

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bulletins

—Starts on page 98

232—Boiler Baffles

"More Steam from Your Boilers," a 4-page folder, explains how streamlined baffles are applied to all types and sizes of the company's boilers. Drawings indicate how they are installed in each specific unit to secure crossflow of gases. The literature also points out how gas passes are tapered in area to obtain necessary velocity for maximum heat transfer. The Engineer Co.

233—Off-Center Firing

Design features of a compact, automatic package boiler are discussed in 4-page folder EC-1152. The theory of off-center firing, used with these units, is discussed. Specifications for units through 250 hp are tabulated. Dutton Boilers Div., Hapman-Dutton Co.

234—Vertical Unit Boiler

More than 25 years of development, manufacturing, and application experience are reflected in the design of the Type VU-10 vertical-unit boiler described in 16-page bulletin VU 10-8. Advantages and design features are discussed. Various possible installations are shown by photographs and cross-sectional drawings. Combustion Engineering, Inc.

TO REQUEST FREE BULLETINS

Circle "key" numbers on Reply Card between pages 34/35 & 94/95. Your requests will be handled promptly.

235—Steam Generators

The advantages of shop-assembled power for your plant with Type-A water tube steam generators are explained in 8-page bulletin 52-1. Line drawings show the flexibility of design possible and dimensions. The Wickes Boiler Co.

236—Coal-Burning Installations

"Burning Bituminous Coal the Modern Way," contains 24 pages of case histories from industries of all sizes and types. Engineering survey results for equipment such as boilers, stokers, coal and ash handling units, and automatic controls, include annual fuel consumption and operating costs. Bituminous Coal Institute.

237—Water-Tube Steam Generators

Data and specifications for factory assembled units in sizes ranging from 5300 to 33,000 lb per hr are presented in an 8-page brochure. For pressures up to 400 psi, they are designed to provide fully automatic firing with oil, gas, or stoker-fired coal. Superior Combustion Ind., Inc.

238—Spreader Stokers

Reasons for firing with spreader stokers, together with distinctive design and operating characteristics of spreader stoker feeder units, are outlined in a 46-page brochure. Case studies point up construction details, advantages of traveling grate units, and installations. Riley Stoker Corp.

239—Catalog

A wealth of research, engineering, and manufacturing experience, gained since the founding of this company in 1880, is incorporated in the products described in this 4-page folder. Steam generators, heat transfer equipment, pressure vessels,

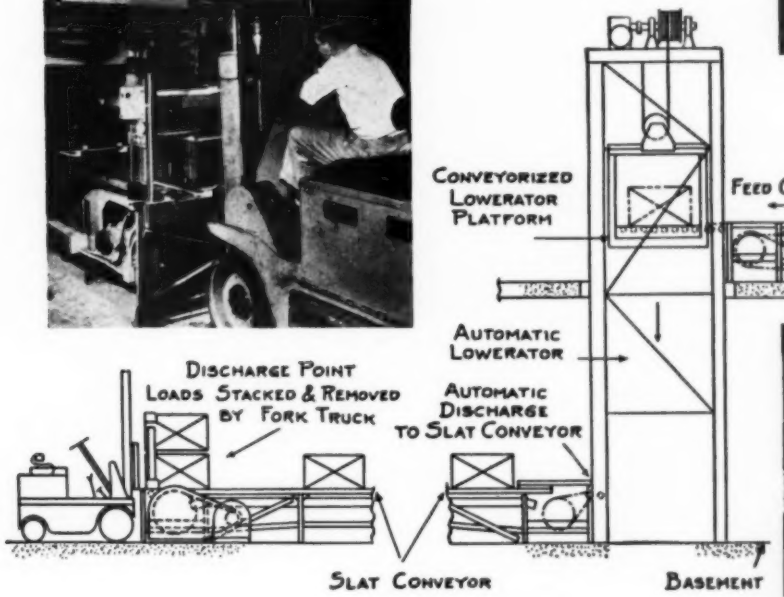
only through *Engineering*

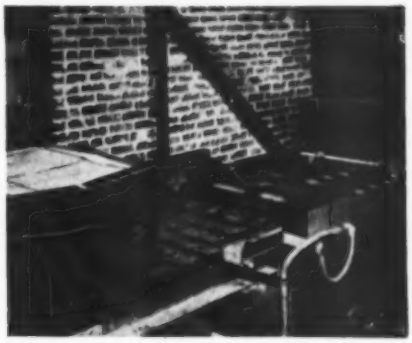
can *Efficiency* be achieved...

up 87½%

for department of a

LARGE EASTERN CAN COMPANY*





Like many foresighted manufacturing companies of today, this large eastern can manufacturing company, is constantly aware of in-plant materials handling as a major operating cost. The diagram and pictures present Gifford-Wood's solution to their problem of handling materials to storage. Long, empty return runs of the fork trucks used was only one aspect of the previous method of operation which was unduly expensive. Through the new G-W System, 2500-lb. bundles of steel sheets which formerly required eight hours to unload and store are now handled in one!

Working with Wigton-Abbott Corporation, Consulting Engineers, Gifford-Wood applied the materials handling knowledge for the solution of a costly problem—and this is only typical of many such engineered installations. All elements of such an installation (length of horizontal conveyor travel, raising or lowering to floors above or below, etc.) are, of course, designed to best suit the particular conditions encountered.

The G-W Materials Handling Engineer in your area will be glad to discuss the most economical means of materials flow in your plant. Call on him—it may well be the first step toward higher profits through lower operating and maintenance costs.

**Company name available on request.*

GIFFORD-WOOD CO.

Since 1814 • Hudson, New York

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8307

When you think of materials handling—Think of Gifford-Wood

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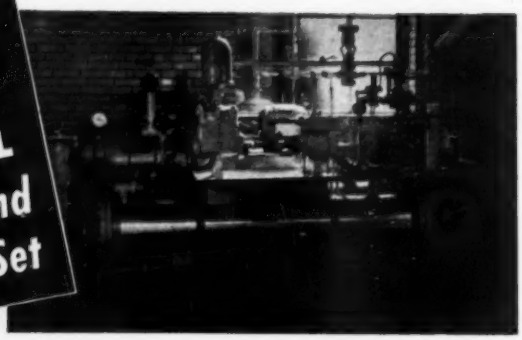
ENCO
DUAL FUEL-OIL Heating and Pumping Set



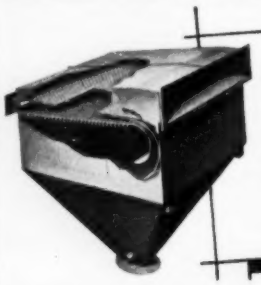
Two heaters and two pumps—one steam, one electric driven—in one set with these six features:

1. Completely automatic operation with temperature and pressure regulation.
2. All essential equipment—including safety valves as needed—in one compact unit.
3. Individually designed to meet the specific needs of the power plant.
4. All parts visible and accessible for easy operation, maintenance and repair.
5. Pumps run at moderate speed. Heaters designed to give the correct viscosity and velocity without fouling.
6. Cleaner boiler room . . . all overflows connected to a common outlet, flanged drip pan for pumps catches oil drip.

EC490

THE ENGINEER COMPANY
75 WEST STREET, NEW YORK 6, N. Y.
IN CANADA: ROCK UTILITIES LTD., 80 JEAN TALON ST. W., MONTREAL, P. Q.

For Larger-Boiler Fly Ash Collection and Valuable Dust Recovery



Solves Big Problem for Small Boiler Operators!

BUELL 'SF' ELECTRIC PRECIPITATOR

BUELL MECHANICAL CYCLONE SYSTEM

Buell 'LR' Collector gets 99% of all 100-mesh and larger cinder discharge. Top efficiency for boilers from 100 to 2000 BHP.

Draft loss so low you can use 'LR' on the smallest natural draft boilers.

Get all the facts—write for 'LR' Bulletin. Buell Engineering Company, Dept. 90-L, 70 Pine Street, New York 5, New York.

buell
Engineered Efficiency in
DUST COLLECTION

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bulletins

—Starts on page 98

valves and fittings, and refrigeration equipment are pictured. Henry Vogt Machine Co.

240—Oil Burning Equipment

Detailed information on oil burners, combination gas and oil burners, oil pumps, and accessories in 20-page booklet 3048, explains how to select a burner, engineering and manufacturing factors, use of panel or control boards. Petro Div.

241—Boiler Service Valves

Surface blow, bottom blow-off, water column blow-off, and connections are covered in 22-page bulletin E125, with complete specifications, materials, and dimensions of each type. Valve operation is explained by illustrations. Fire protection valves are included. Everlasting Valve Co.

242—Tube Expanders

Rolling and flaring tube expanders and operating accessories are listed in illustrated 8-page catalog 68. General information, specifications, and recommendations are included. A useful guide for ordering is also presented. The Gustav Wiedeke Co.

243—Multi-Stage Turbines

Smaller framed, multi-stage turbines are featured in 6-page bulletin. Overspeed governor, governor valves, blades, diaphragms, and many other design features are discussed and illustrated. The Terry Steam Turbine Co.

244—Boilers & Stokers

Over 88 years experience are embodied in the design and construction of Scotch Marine type portable boilers says 28-page catalog. Advantages of this internally-fired, return-tubular boiler are thoroughly discussed. Photographs and cross-sections illustrate various models ranging in capacities from 6 hp up to 250 hp. Details and features of underfeed stokers designed especially for this type boiler are contained in separate section. The James Leffel & Co.

245—Fuel Systems

Over 50 years of experience in steam generation backs up 29-page bulletin "Pulverized Fuel Systems." Well illustrated with cross-sectional drawings and graphs, it gives advantages, typical installations, and descriptions of major operating parts. Foster Wheeler Corp.

246—Burners

Combination gas and oil burners, designed for boilers and process furnaces where maximum heat release at low excess air and high heat density place a premium on reliable burner performance, are covered in 4-page bulletin. Series Y and YC burn any commercial fuel oil and any gas at reasonable pressure says 4-page bulletin. Other features along with a sectional drawing and a Btu capacity curve are given. John Zink Co.

BUILDING MATERIALS & MAINTENANCE

247—Masonry Water Repellent

Discussed in a 4-page folder is an inorganic water repellent designed for brick, concrete, sandstone, stucco, asbestos cement combinations, cement base paints, and other composition surfaces. The bulletin explains how the product eliminates

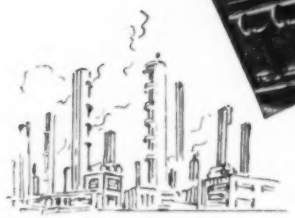
THIS 400,000 Pounds per HOUR

Vogt

STEAM GENERATOR

Gives Top Performance in a Leading Texas Petroleum Refinery

VIEW OF THE COMPLETED STEAM GENERATOR



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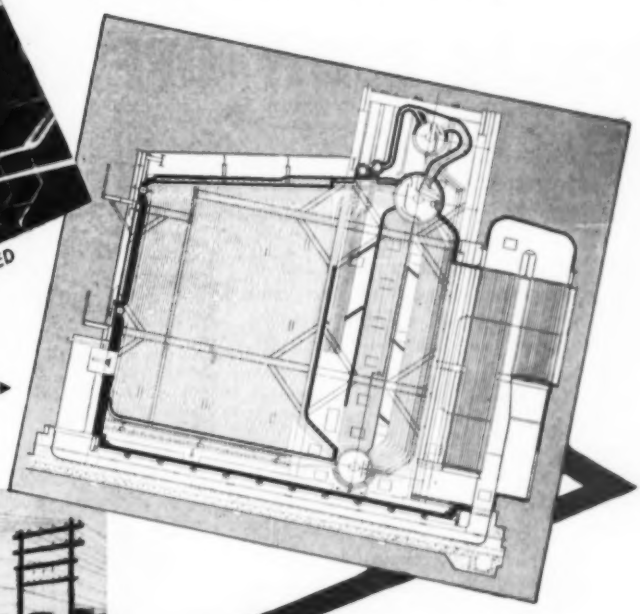

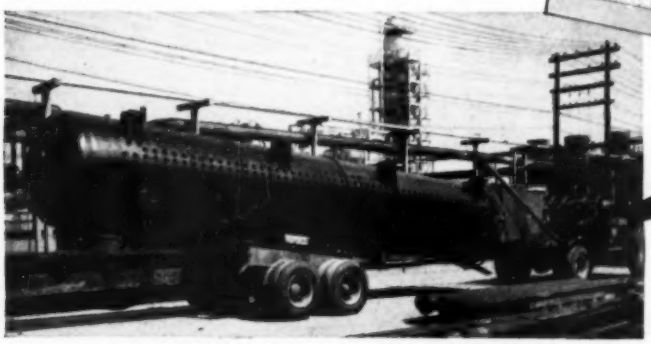

6'-6" DIAMETER x 37'-0" LONG STEAM DRUM BEING TRANSPORTED TO THE ERECTION SITE DURING INSTALLATION.

PRINCIPAL DATA

400,000 pounds per hour capacity.

Fusion welded steam and water drums designed for 700 lbs. S.W.P.

Superheater delivers steam at 750°F. total temperature.

Water cooled furnace.

Burners for Oil and Acid Sludge fuel.

Vogt builds a complete line of bent tube steam generators designed to burn solid, liquid, or gaseous fuels to meet specific operating conditions. Write for bulletins.

HENRY VOGT MACHINE CO., LOUISVILLE 10, KY.

BRANCH OFFICES: New York, Philadelphia, Chicago, Cleveland, St. Louis, Dallas, Charleston, W. Va.

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These EVERLASTING advantages give better service from

Fig. 4001/6561. Duplex unit consisting of Straightway Lever-operated Valve and Angle Valve.

BOILER BLOW-OFF VALVES

When you install an EVERLASTING Duplex Blow-Off Unit, you'll find that its many superiorities speak for themselves.

The valve at the left is the EVERLASTING design that has been famous for more than 40 years . . . the valve with the drop-tight seal that actually improves with use because of its self-lapping action each time the valve is opened or closed . . . the valve that can't stick or jam because of its non wedge design . . . the valve that opens in less than a quarter turn to provide unimpeded straight-through blow.

The valve at the right is the equally famous EVERLASTING Angle or "Y" Valve, specially designed and equipped to withstand repeated blow-off shocks, erosion and corrosion, and without pockets that might trap and hold solids.

Each of these valves . . . and all the other EVERLASTING Boiler Blow-Off valve types, fully meet ASME code requirements . . . assurance that they are properly designed and amply strong for the service.

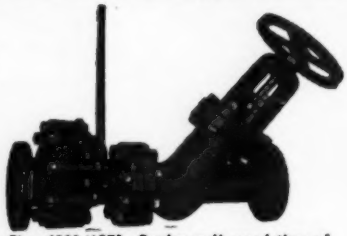

Fig. 4001/6571. Duplex unit consisting of Straightway Lever-operated Valve and Y Valve.

Fig. 6571/6561. Duplex unit consisting of Y Valve and Angle Valve.

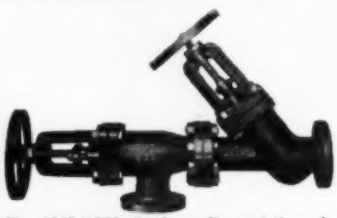

Fig. 6561/6571. Duplex unit consisting of Angle Valve and Y Valve.

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49 Fisk Street, Jersey City 5, N. J.

Everlasting Valves

TRADE MARK "EVERLASTING" REG. U.S. PAT. OFF.

EV-348

FOR EVERLASTING PROTECTION

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bulletins

—Starts on page 98

dampness on interior wall surfaces and lists many other advantages. The result of accelerated weathering tests are appraised. Flexrock Co.

248—Iron Cements

Suggestions for simple reliable repairs on equipment and piping using iron cement are presented in 40-page pocket-size pamphlet. Patching cement, aluminum and bronze cement, concrete paint, gaskets and clamps are also presented. Also included is a folder describing advantages and how to apply concrete paint No. 15, for interior or exterior use. Smooth-On Manufacturing Co.

249—Tube Cleaners

Equipment for practically every tube cleaning operation is presented in 28-page catalog Y-29. Specifications for cutter heads, drills, brushes, and motors are listed in illustrated tables for quick reference. Cutaways show design features of air, steam, water, and electric powered motors. Accessories are also presented. Sections on care and operation of tube cleaners and table of inside diameters for tubes and pipes add to the booklet's value. Elliott Co., Lagonda Div.

DIESELS & GAS ENGINES

250—Gas Diesel Engines

Engines for gas, gas-diesel, and diesel operation described in 12-page booklet L-71, are 4-cycle, with 15½ in. bore and 22 in. stroke. A rating curve compares supercharged to atmospheric operation. Aftercooling for more horsepower is discussed. Space requirements are listed and typical installations are shown. Cooper-Bessemer Corp.

251—Diesel Engines

Smaller and lighter, but for heavy-duty service is the description of a diesel engine discussed in 12-page bulletin 10027. Three models are listed, ranging from 200 to 380 hp at 900 to 1000 rpm. Specifications and performance curves are included. Ingersoll-Rand Co.

ELECTRIC EQUIPMENT

252—Circuit Breakers

"What You Should Know About Circuit Breakers," 16-page manual 101, explains the operating principles of basic circuit breaker design. Included are simplified diagrams of three basic types. Explanations, charts and diagrams deal with temperature factors, inrush current effects, tripping and reset time, quick and slow make-and-break, and wire deterioration rates. Heinemann Electric Co.

253—Commutators and Slip Rings

"Commutator and Slip Ring Maintenance," 39-page handbook, covers trouble shooting, brush maintenance and operating procedure, and general maintenance. Illustrations show the operations described. Ideal Industries, Inc.

254—Wire and Cable

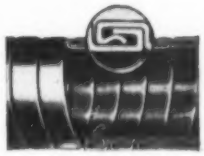
"Wire and Cable for the Chemical Industries," a 19-page booklet, discusses the various types of cable that best withstand the moisture and corrosive conditions, chemical exposure, and atmospheric contamination present in chemical plants. Full specification data, product

CMH

One dependable source for every flexible metal hose requirement

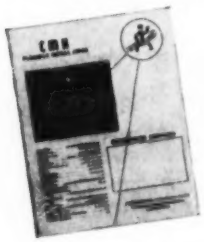
CMH corrugated hose is available with metal braid covering or unbraided in steel, bronze or stainless steel. Used where great flexibility is required at high temperatures and high pressures. Sizes range from 3/16" I.D. to 24" I.D. Depending on size, type and material, it will handle burst pressures to 12,000 psi, temperatures to 1200° F.

CMH interlocked hose is available in various types, packed and unpacked, in steel, stainless steel, bronze, aluminum, brass and other metals. It is used for steam, exhaust, tar and asphalt, etc. Sizes ½" to 12", I.D. Depending on size, type and material, it may be used for working pressures to 750 psi (constant), temperatures to 600° F.



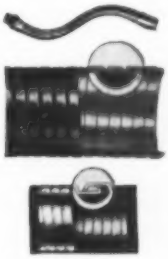
CMH double groove (ball bearing design) hose is available in bronze, steel or stainless steel with asbestos packing and with or without metal braid covering. Widely used for non-searching liquids and gases at low to moderate pressures and temperatures. Sizes range from ½" to 1¼", I.D.

CMH square locked hose is available unpacked or with a choice of several types of packing in steel, bronze, brass, aluminum, stainless steel, etc. It is used as conduit, cable armor, nozzles and many similar applications. Sizes range from 3/16" to 1", I.D. Normally used only at very low pressures.



For full information on all CMH hose products write for Catalog 130 or see the Flexonics catalogs in Sweet's Plant Engineering File, Chemical Engineering Catalog and The Refinery Catalog. For maintenance hose, see the classified pages of your telephone directory for the name of your CMH distributor.

Standard assemblies and special purpose flexible metal hose items are manufactured for such services as steam, tar and asphalt, machine tool coolants, machine tool wiring conduit, dry granular products. We will be pleased to send data on any specific requirement.



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THE ORIGINAL COMPOSITION CUP

PUMCUPS

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bulletins

—Starts on page 98

photographs, and actual installation illustrations are included. Electrical engineers in chemical plants should find this bulletin useful. Construction Materials Div., General Electric Co.

256—Eddy-Current Machinery

"Basic Principles of Eddy-Current Machinery," a section of 16-page bulletin GB1, explains the fundamental principles of generating torque by means of eddy-current devices. Another section, "Characteristics of Rotating Equipment," contains engineering data. Descriptions are included of typical eddy-current equipment such as adjustable speed drives and couplings. Dynamatic Corp.

257—Conduit and Cable

Catalog 65, 63 pages, covers the entire line of electrical conduit and cable fittings manufactured by this company. Each product is indexed for easy reference. Tables list current-carrying capacities, dimensions, weights, and decimal equivalents. Thomas & Betts Co.

258—Induction Motor Standards

New NEMA standards for 1 to 40 hp induction motors have been published in 7-page bulletin 1600. A comparison of the principal dimensions of the old and new NEMA frames is included in table form. The Louis Allis Co.

FILTERS, STRAINERS & PURIFIERS

259—Valves and Strainers

Forty years of service are behind the information presented in bulletins 128-A (pipeline strainers) and 228 (pressure reducing valves). Cross-sections, tables, and diagrams are used to point out the advantages of this company's products. McAlear Manufacturing Co.

FANS & BLOWERS

260—Centrifugal Blowers

Descriptive material on centrifugal blowers, manufactured by this company, is included in 24-page catalog B-10. Dimension drawings and complete air delivery tables are given for each model. Hartzell Propeller Fan Co.

HEAT EXCHANGER EQUIPMENT

261—Heat Transfer Equipment

Various types of heat transfer equipment are among the products described in 12-page catalog 12. Also presented are various types of dry blending equipment and such process equipment as kettles, evaporators, vessels, reactors, and coils. The Patterson-Kelley Co., Inc.

INSTRUMENTS & CONTROLS

262—Feedwater Gas Analyzer

Described in 4-page folder 148BP is an analyzer for measuring dissolved oxygen and hydrogen in feedwater. Advantages, ranges, and accuracy are discussed. Cambridge Instrument Co., Inc.

263—Instrumentation

Illustrated 8-page booklet R-8, entitled "Results," presents the case histories of a large independent electric power producer. In addition to discussions of the use of

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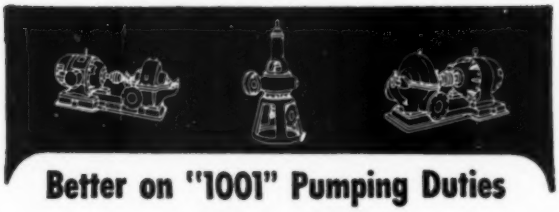
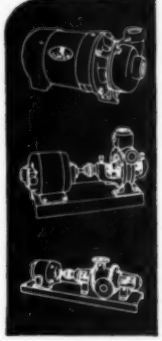


Better on "1001" Pumping Duties

Capacities to 150 G.P.M.

Heads to 500 Ft.



APCO Two-Stage Turbine Type Pump for High Pressure Service

Apco—the pump with but one moving part, the impeller — is famous for long-lived, efficient performance on small capacity, high head duties. Available in Single Stage, Two Stage and 4-Stage Tandem for high pressures — and Water Jacketed for high temperature and highly volatile liquids.

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RUST and Scale, bad characters in any pipe line, will cause serious damage to equipment and control accessories unless apprehended. This is a job for an Armstrong Y-Type strainer, which "polices" any line—steam, air, gas, water or oil—effectively.

Armstrong strainers are cast semi-steel for 250 psi maximum pressure and come in sizes from ¼" to 2". Available with brass or stainless steel screens from stock.

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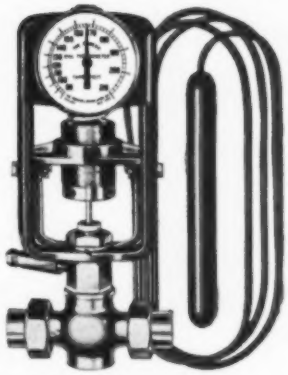

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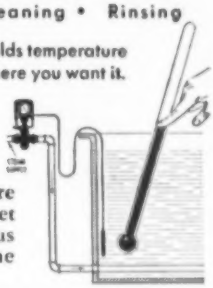
Holds temperature where you want it.



Saves LABOR and Steam
Helps Eliminate Costly Rejects

Powers No. 11-MF Regulators are self-operating. They will help you get the most effective use from various solutions by holding them at the right temperature automatically.

Plastic Covered Thermal Bulb and Tubing—is highly resistant to solutions in above processes. Prevents electrical shorts. No insulators required for the regulator.

Easy to Read 4" Dial Thermometer—indicates temperature of liquid being controlled and makes it easy to adjust regulator for different temperatures.

Bulletin 330 describes this simple, dependable control. May we send you a copy? (b31)

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Offices in over 50 Cities, see your Phone Book • Established in 1891

Sims

VALVES ARE GUARANTEED to last longer in any pump

HERE'S HOW...

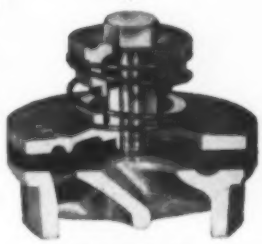
Stem breakage eliminated – by exclusive double shock-absorber stem heads.

Reduced wear - long guide gives even lift. Springs can't jam.

Smooth seating surface– rotating valve disc changes to new seating surface with every pump stroke.

Reduced flow resistance– accomplished by Sims inclined seat-ribs.

Sims Pump Valves, for all reciprocating pumps, are stocked for quick delivery.



Write for Bulletin IP-1 explaining how Sims Valves can improve your pump operation at lower cost.

SP-104

SIMS PUMP VALVE CO., INC.

1314 PARK AVENUE, HOBOKEN, N. J.

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High-test, air-refined malleable iron is tops for resisting stress and stretching. Look for it in Dart bodies and nuts.
Note Dart's non-corroding bronze seats. True bearing surface makes joint absolutely leak-proof.
Real wide seats give a drop tight joint easily.
Note Dart's threads — full, and clean cut. Stronger metal keeps them from deforming or stripping.
This extra heavy nut thrives on wrenching.
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Darts can be used over and over again. That's real economy.
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bulletins

—Starts on page 98

steam, fuel and ash handling, and plant steam demand, the combustion control system is also fully described and illustrated. The Hays Corp.

264—Recording Potentiometer

Cutaway drawings of operating sections stressing simplicity of construction are given in 14-page booklet P-2-A. The method of changing chart speed and range is explained. Standard chart ranges, specifications, and information on how to order are listed for the single point recorder. Weston Instrument Corp.

265—Mold Temperature Control

Discussed in 8-page technical bulletin 7 is the problem of maintaining proper temperature control of injection molding equipment. Included is a chart which lists the mold difficulties which occur with various thermoplastics when the temperature is too high or too low. Features of a heating and cooling unit are detailed. Sarco Co., Inc.

HEATING, AIR CONDITIONING & REFRIGERATION

266—Electric Comfort Heaters

Listed in 8-page catalog D-52 are 75 different models of forced air, convection, and radiant heaters in capacities of ¼ to 100 kw. Aids include a quick selector chart which shows how to calculate heat requirements for given areas and types of buildings. Edwin L. Wiegand Co.

LUBRICANTS & LUBRICATION EQUIPMENT

267—Lubricating Oil

Excellent time-temperature characteristics, and application by any method are advantages listed in technical data sheet 17, for newly developed lubricating oils. Physical properties and other advantages are discussed, and a chart shows service life characteristics. Sun Oil Co.

268—Force Feed Lubricator

High pressure force feed lubricators, designed for service at pressures to 30,000 psi, are dealt with in 12-page catalog 25G. Tables show output, dimensions, and specifications. Information is given on how to order the correct unit and fittings. Manzel Div., Frontier Industries, Inc.

MATERIALS OF CONSTRUCTION

269—Nickel Alloys

Helpful technical publications covering the many aspects of nickel alloys, and their applications, are listed in 2 bulletins. Instructions on how to order literature, free of charge, are included. The International Nickel Co., Inc.

MATERIALS HANDLING EQUIPMENT

270—Coal Handling Equipment

Applications of coal handling equipment for the power plant, pictured in 40-page brochure 2410, illustrate the cumulative experience gained in thousands of installations over more than 75 years. Drawings show tested layouts for various operating conditions. Link-Belt Co.

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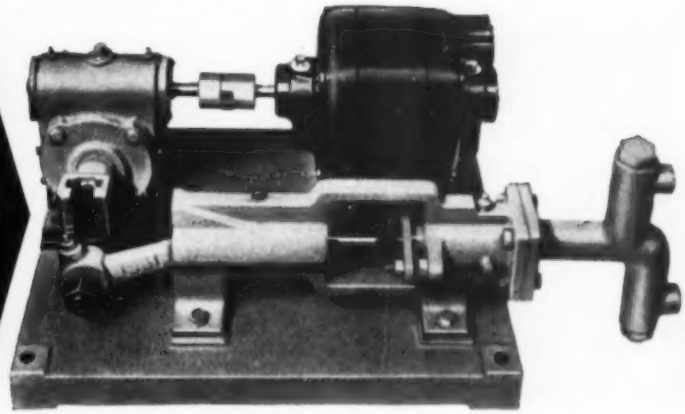
for water softening,
boiler treatment and
all chemical applications..
we introduce

ORCHEM
LITTLE GIANT PUMP

small . . . compact . . .
efficient . . . economical . . .



As its name implies, the *Orchem Little Giant Pump* is small and compact. But it's designed to do a *big* job, economically. It's ideal for water softening, boiler treatment and all chemical applications up to a P.S.I. of 800 lbs.

In addition to the *Little Giant*, Orchem makes many types and sizes of standard and special pumps for every conceivable purpose. Efficient and economical, the *Little Giant Pump's* advantages result from Orchem's many years of "know-how".

Every Orchem pump is thoroughly tested for volumetric efficiency, conformance to pressure requirements and general mechanical operation under actual operating loads.

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EXCLUSIVE "INJECTO" VALVE

Suction and discharge sides consist of a radically new integral double ball and seat unit—two balls and two seats—in one complete unit. Direct flow in and out assures minimum slippage. Non-air binding. Maximum displacement efficiency. Inexpensive units easily removed with large standard screwdriver.

MANAJUST . . Manual Stroke Adjustment

Standard on all Orchem pumps. Permits accurate control and repeatability from 0 to 100% of ratio capacity, adjustable when pump is not in operation. Locks in place for safety regardless of pressure.

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KEYNOTES

"Hasten with that KEY-TITE, knave, the rain is almost on us."

The perfect WATERPROOF sealer for pipe joints carrying water, gas, and low-pressure steam.

Write for free sample today!

SEALS TIGHT...
BREAKS RIGHT!

A Product of KEY COMPANY

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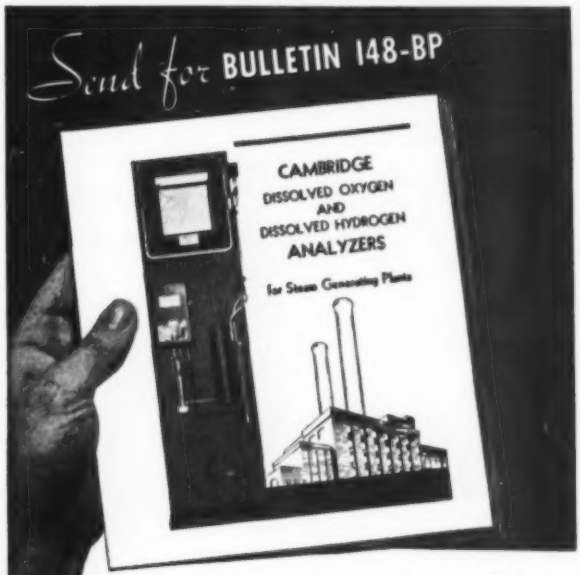

Continuous records of the oxygen dissolved in boiling feed water and of the hydrogen entrained in steam, point to the corrective measures necessary to prevent otherwise unsuspected and costly corrosion. The Cambridge Analyzers measure and record dissolved oxygen directly. The hydrogen in the steam is measure of the oxygen set free by dissociation. Cambridge Instruments are available for recording O_2 and H_2 either separately or simultaneously.

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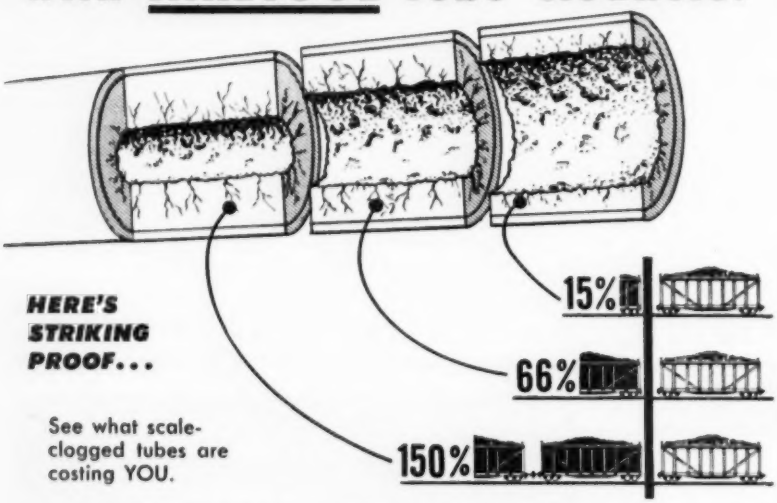
SAVE FUEL COSTS

with AIRETOOL tube cleaners!

Remember – tube scale costs money! As scale deposits increase in thickness efficiency drops, and fuel costs mount rapidly. Keep your plant at peak efficiency – use AIRETOOL Tube Cleaners and Expanders when overhauling boilers and condensers. Powerful and flexible, AIRETOOL Tube Cleaners quickly and thoroughly remove deposits from both straight and curved tubes, keeping costly downtime at a minimum.

For information on how *you* can cut excessive fuel costs, write to The AIRETOOL Manufacturing Co., 318 S. Center St., Springfield, Ohio.



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See what scale-clogged tubes are costing YOU.

1/16" thick scale deposit—15% additional fuel required!
1/4" thick scale deposit—66% additional fuel required!
1/2" thick scale deposit—150% additional fuel required!

There's an AIRETOOL Tube Cleaner and Tube Expander for every Type of Tubular Construction.

The forwardly swing arm type cleaner head is designed for efficient and rapid cleaning in tubes of short radius. For tubes of 2" to 5⅛" I.D.

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BRANCH OFFICES: New York, Philadelphia, Chicago, Tulsa, Baton Rouge, Houston, Hudson Heights, N. J.

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—Starts on page 98

271—Conveyor System

How a recently installed interfloor-conveyor system cut receiving-to-storage time is discussed in a reprint. The article tells how the system eliminated a long truck haul, stopped elevator congestion, and reduced unloading time of highway trucks. Included are descriptions of the vertical interfloor conveyor, feeder conveyor, take-away conveyor, and automatic control system. Gifford-Wood Co.

MECHANICAL POWER TRANSMISSION

272—V-Belts

Fractional horsepower V-belts, for use in servicing light duty applications, are cataloged according to the new industry-standard numbering system. Various types of machines are listed alphabetically by company or trade names for convenience in determining the proper belt. Manhattan Rubber Div., Raybestos-Manhattan, Inc.

273—Electric Clutch

Principles of operation of an electrically controlled clutch are explained in 16-page bulletin 5306. It gives engineering information on how to apply, how it operates, and control. Specifications are listed. Rectifier Div., I-T-E Circuit Breaker Co.

274—Steel Collars

Steel shaft collars are shown in use on industrial lift trucks, printing presses, textile machinery, and other industrial equipment. Advantages of this type of collar are listed and a specification table is included. Standard Pressed Steel Co.

275—Disc Brakes

Airplane-type disc brakes for industrial uses are the subject of 8-page bulletin A1725K. In addition to pointing out the advantages of employing single disc brakes, the booklet also describes a few of the varied industrial applications. Industrial Brake Dept., Aviation Products Div., Goodyear Tire & Rubber Co.

PIPE, TUBING & HOSE

278—Pipeline Expansion Joints

All the basic data necessary to the proper selection and application of pipeline expansion joints are presented in 8-page bulletin 133. Highlights of the bulletin include a discussion of types of pipeline motion frequently encountered, and methods of handling this motion, complete specifications for low and high pressure units, and detailed information on special types of joints including Flexonl-flex, good for pressures to 5500 psi. Flexonics Corp.

PUMPS & COMPRESSORS

279—Proportioning Pump

An explanation of the operation and advantages of reciprocating mechanical drive metering and proportioning pumps is given in 20-page brochure UP-52. Technical information on how to select the proper unit as well as service recommendations for handling over 300 substances is presented. Hills-McCanna Co.

281—Vertical Pumps

"Vertical Pumps for Volatile Fluids," 6-page folder 1026, appraises the advan-

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Hazel Brook—*Premium Lehigh*
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Our engineering service, available upon application, and long and varied experience is your assurance of the Right Coal — Properly Applied.

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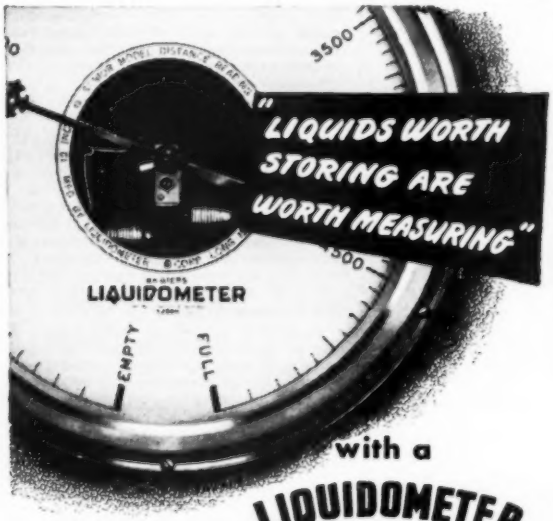

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- APPROVED BY UNDERWRITERS' LABORATORIES

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SOLID STEEL COLLARS

now size-marked for easy identification

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HALLOWELL POWER TRANSMISSION DIVISION

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FLEXIBLE COUPLINGS

- provide maximum alignment correction for smooth power transmission
- dampen and absorb vibration, starting torque, and shock of intermittent loads
- increase operational efficiency and economy
- protect motor and machine
- lengthen service life

WRITE TODAY for Catalog and Handy Selector Charts

Also Mfrs. of Lovejoy Universal Joints and Variable Transmissions

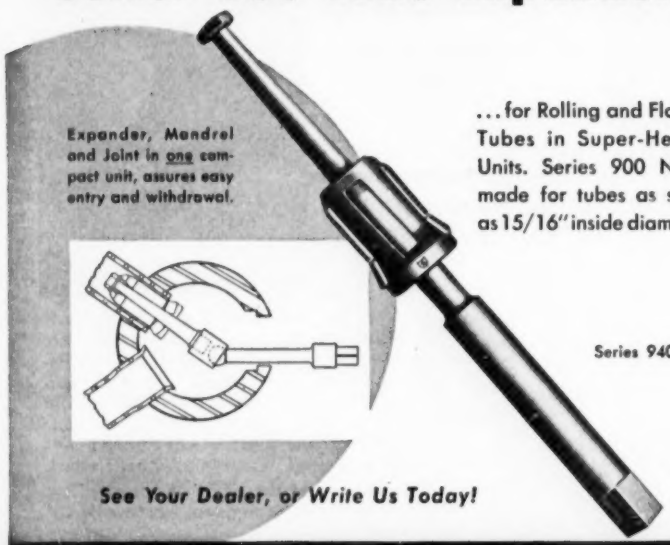
LOVEJOY FLEXIBLE COUPLING COMPANY

5043 W. LAKE STREET CHICAGO 44, ILLINOIS

IDEAL

the answer to small hand hole problems!

Series 900 Tube Expanders



Expander, Mandrel and Joint in one compact unit, assures easy entry and withdrawal.

...for Rolling and Flaring Tubes in Super-Heater Units. Series 900 NOW made for tubes as small as 15/16" inside diameter.

Series 940

See Your Dealer, or Write Us Today!

THE GUSTAV WIEDEKE COMPANY

DAYTON 1, OHIO

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bulletins

—Starts on page 98

tages of vertical turbine pumps for handling such liquids as gasoline, diesel fuel, crude oil, L-P gases, and ammonia. Efficiency curves included. Johnston Pump Co.

282—Pump Valves

Pump valves and graphite packings are delineated in 24-page brochure SC-510. Types, details of construction, design features, applications, how to order, and dimensions are included. Heaters for heating water by blending with steam are also presented. Sims Pump Valve Co., Inc.

283—Controlled Volume Pumps

Design features and construction of motor-driven controlled volume pumps are detailed in 40-page booklet 53. Technical data include capacity adjustments, standard and special designs, and packaged systems. Describes typical applications in 6 major industries. Milton Roy Company.

REFRACTORIES

284—Refractories & Insulations

Catalogs R-52 through I-93, compiled in a binder, form an illustrated 40-page booklet showing where, when, and how to use various types of materials for industrial heat generation and processing equipment. An index is included for quick reference. Refractory & Insulation Corp.

285—Refractories

Charts which show at a glance the properties of refractory castables, plastics and mortars are featured in 20-page catalog R-22. Important information including recommendations for each is presented. Photos depict application and end results. The Babcock & Wilcox Co., Refractories Div.

STEAM SPECIALTIES

286—Steam Gage Illuminators

Mercury vapor illuminators for steam gages are the subject of data sheet 196. Unmistakable water level indication is provided by a brilliant green spot at the water level. How it is installed on standard gages is discussed. Jerguson Gage & Valve Co.

288—Steam Traps

Engineers concerned with steam traps should find 48-page catalog J a valuable source of data on recommended trapping practice. In addition to explanation of how to calculate condensate loads and select traps, a maintenance section covers installation, preventive maintenance, trouble shooting, and repair. Armstrong Machine Works.

289—Trap Selector

Handy, 20-page bulletin T1750 lists common industrial and process equipment and shows how to select proper size trap for each type. Tables show trap capacities, factors of safety, and pressure conditions. Installation recommendations are included. Yarnall-Waring Co.

TOOLS

290—Installation & Maintenance

Tube expanders, air motors for driving them, buffing tool, polishing wheels and brushes, tube calipers, wrenches, jigs, plug pulling devices, and other essential tools for the correct assembly and satisfactory operation of return bend

fittings and tubes are pictured and described in 16-page bulletin 451. Includes table of expander sizes. The Key Co.

VALVES & REGULATORS

291—Temperature Regulator

Bulletin 330 fully describes a simple, self-operating temperature regulator for plating, anodizing, bonderizing, pickling, cleaning, and rinsing solutions. The Powers Regulator Co.

292—Regulating Valve

How control function of a pilot-operated valve can be changed by using a different sensitive pilot is explained in 4-page folder 700. A large cutaway illustration of the valve and a detailed description of design features are included. Spence Engineering Co., Inc.

293—Solenoid Valves

Such solenoid valve specialties as single step valves, two step valves, normally open or closed valves, three and four way valves, and remote control valves are described in 20-page booklet 700. Applications, service, operation, and construction are presented for each unit. Tables list specifications. Davis Regulator Co.

TO REQUEST FREE BULLETINS
Circle "key" numbers on Reply Card between pages 34/35 & 94/95. Your requests will be handled promptly.

WATER TREATMENT & WASTE DISPOSAL

294—Water Analysis

Published by a company engaged exclusively in the solution of industrial water conditioning problems, this 14-page brochure contains brief descriptions of testing and control equipment necessary for the more common water analyses. W. H. & L. D. Betz.

295—Waste Treatment

How this company has solved waste treatment problems for such industries as electro-plating, refinery, gas, and metal finishing is treated in detail in 6-page booklet 70-B. Cross-sections show the various types of chemical and biological treatment equipment. A handy bibliography serves as a reference for more information on waste treatment in each of the industries covered. Infilco, Inc.

296—Water Purification

"Boiler Feedwater Treatment," 19-page bulletin BFT-1, covers Inversand zeolite softeners, cold process chemical softeners, and demineralizing units, including silica removal by ion-exchange. Each process is explained by means of chemical formulas and flow diagrams. Photographs and cross-sections of equipment are included. Hungerford & Terry, Inc.

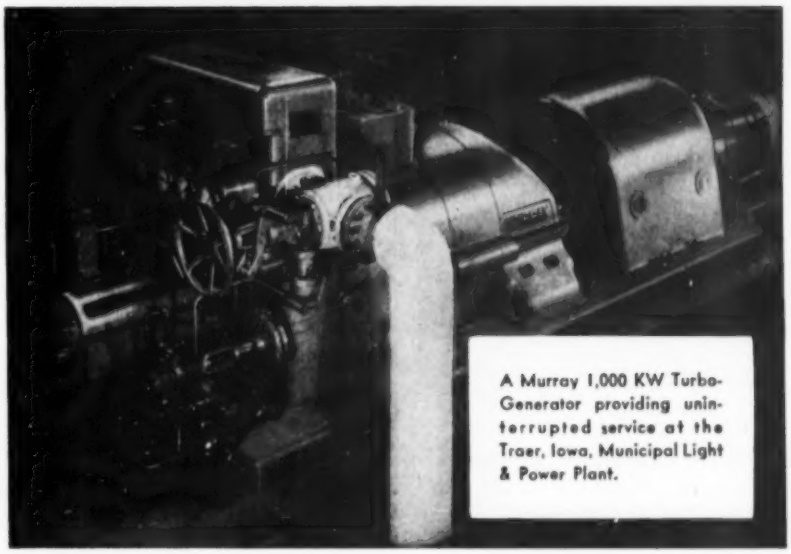
297—Ion Exchangers

This 14-page booklet reviews generally the subject of ion exchange, established and potential applications. It gives advantages of the synthetic ion exchange resins and a bibliography of papers concerning their use. Rohm & Hass Co.

298—Ion Exchange Material

Strongly basic anion exchanger is presented in 16-page bulletin 57. Includes complete data on physical characteristics, exchange capacity and regeneration technique. Tables and graphs along with discussions explain performance under various operating conditions. National Aluminate Corp.

Murray Turbines



A Murray 1,000 KW Turbo-Generator providing uninterrupted service at the Traer, Iowa, Municipal Light & Power Plant.

A typical, modern, small public utility is the Municipal Light and Power Plant at Traer, Iowa. This plant supplies water, steam heat and electric power to the community and surrounding countryside. The Murray turbo-generator pictured above carries the full electrical load of the plant and supplies the steam for heating by automatic extraction at 10# gauge pressure.

The simplified design and rugged construction of this and all MURRAY turbines particularly adapt them to this or any other drive where long life, reliability and low operating costs are a MUST.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
BUILDERS OF STEAM POWER EQUIPMENT FOR THREE QUARTERS OF A CENTURY
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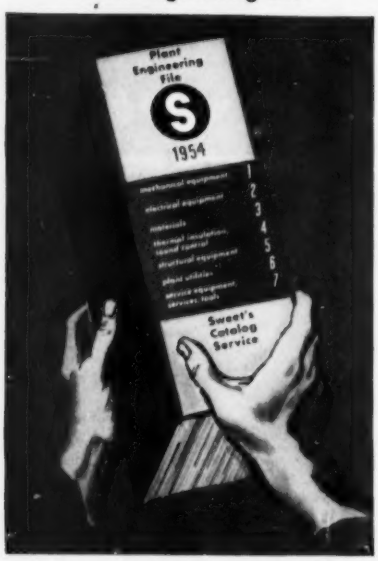
need information on

electrical equipment?

reach for your Plant Engineering File



"...a great time-saver"

These manufacturers' catalogs are instantly available in Section 2 of your Plant Engineering File:

Adams, Frank, Electric Co.
Allen-Bradley Company
Allis-Chalmers Manufacturing Co.
BullDog Electric Products Co.
General Electric Company
Master Electric Company
Mercoid Corporation
Penn Electrical Company
Wagner Electric Corporation
Westinghouse Electric Corp.

In other sections of the File you will find additional catalogs containing useful information on a wide range of products used in the maintenance of all plant facilities.

Sweet's Catalog Service

Division of
F. W. Dodge Corporation
119 West 40th Street, New York 18, N. Y.

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names make news

. . . personalities from industry and power

Worthington Corporation announces appointment of **Kenneth W. Horsman** as general manager of the company's Plainfield, New Jersey Works. **John F. Weissert,** appointed general superintendent of plant operations, will be responsible for all production activities at Plainfield.

American Engineering Company announces that **E. M. Beazel,** for many years manager of field erection and operation of the Stoker Division, has been appointed manager of the company's Chicago office. **Paul N. Dotzenroth,** whom he succeeds, has been elected President of the **Baker Valve Company.** This company will be sales and service representative of the American Engineering Company in the Minneapolis area.

The Special Products Division of the **I-T-E Circuit Breaker Company** has moved from the company's main plant at 19th and Hamilton Streets, Philadelphia, to 601 East Erie Avenue, Philadelphia 34. The new plant houses not only the offices of the Special Products Division, but also facilities for assembling jet engine components.

R. G. Williamson will take over as branch manager of the Los Angeles district office of the **Cooper-Bessemer Corporation.** He is presently in the applied mechanics department responsible for stress and vibration analysis. Another engineer for the same company, **John W. Holmes,** received the highest grades in recent examinations for professional mechanical engineers given to 712 applicants.

Williamson

Schwendener

Carl W. Schwendener is appointed factory manager of the **Elgin Division**

NON-FLUID OIL
TRADE MARK REGISTERED

"NR" Grades Lubricate and Rust-Proof Pneumatic Tools.

"NR" grades of NON-FLUID OIL absorb the moisture in compressed air to form a stable and permanent emulsion which both *lubricates* and *rust-proofs* pneumatic tools. During idle time, there is no separation of the moisture from the oil . . . all surfaces have a constantly maintained protective film, without any dry areas or streaks where rusting or corrosion can take place.

NON-FLUID OIL . . . the modern lubricant is available in many "NR" grades to meet specific air tool lubrication problems. It is especially made to stay on bearing surfaces, does not blow through tools as quickly as ordinary lubricants, and lasts 3 to 5 times longer.

Write for Bulletin 2530 and free testing sample of "NR" grade. Try it on your pneumatic tools and prove to yourself the superiority of NON-FLUID OIL.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
292 Madison Ave., New York 17, N. Y. • Works: Newark, N. J.

WAREHOUSES: Atlanta, Ga. • Birmingham, Ala. • Charlotte, N. C. • Chicago, Ill. Columbus, Ga. • Detroit, Mich. • Greensboro, N. C. • Greenville, S. C. Providence, R. I. • Springfield, Mass. • St. Louis, Mo.
Also represented in other principal cities.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 579 on Reply Card for more data

of Flexonics Corporation. Formerly production manager at the Elgin Division, **Richard Benton** is named factory manager of the Rock Falls, Illinois plant.

Two personnel additions in the heat transfer sales department of **The Trane Company** are announced. **Ellsworth A. Brown, Jr.** has been appointed assistant to the manager of process heat transfer sales and **Vernon R. Anderson** is now assistant to the manager of aircraft equipment heat transfer.

Comptroller of the **V. D. Anderson Company** since 1948, **Roy L. Brittain** has been elected treasurer and director of the company. In addition to his new responsibilities, he will continue to head the bookkeeping, cost accounting, and budgeting departments.

Maintenance Engineering Corporation, Houston, Texas, sales representatives for **Graver Water Conditioning Company,** has added **Alvin S. Vener** to its staff of engineers.

Combustion Control Corporation announces the appointment of **Arne Lovendahl** as manager of its Philadelphia area office. He was formerly sales engineer for the Chicago area.

Rohm & Haas Company announces that **Dr. F. Otto Haas** has been elected executive vice-president. Formerly a vice-president and member of the executive committee of the board of directors, Dr. Haas has been engaged in the chemicals and plastics sales division for the past two years.

Link-Belt Company announces the appointment of **Harvey V. Eastling** as general manager of the company's Pacific Division, with headquarters in San Francisco. He succeeds **Ralph M. Hoffman,** who is retiring after 40 years of service.

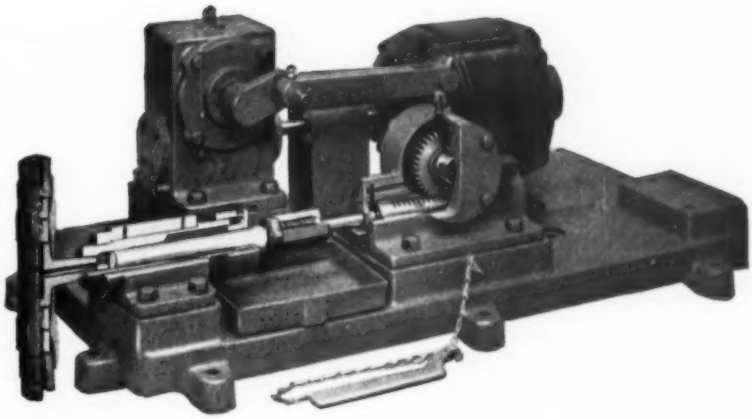
Eastling

Walker

Kenneth L. Walker has been appointed superintendent of the new Mountaintop, Pennsylvania plant of **Foster Wheeler Corporation.** Specializing in welding and fabrication, Walker had been superintendent of the boiler shop at the company's Carteret plant.

The Electronics Division of Diamond Power Specialty Corporation has moved into its new electronics laboratory adjacent to the manufacturing plant at Lancaster, Ohio. The laboratory is being used for the continuing development and construction of the Utiliscope (wired television), and for the development of other electronic instruments and controls.

For continuous, precisely controlled injection of boiler feed water treatment



. . . the HILLS-McCANNA "U" Type Proportioning Pump

The Hills-McCanna "U" Type Pump is designed to continuously meter and proportion small flows of the order of 0.10 to 24 gallons per hour per feed. Its accuracy and reliability ideally suit it for power plant applications such as the continuous injection of internal phosphate treatment and sodium sulphite oxygen scavenging in feed water treatment. Design of the pump is such that it may also be used for batch operations where this is preferred.

The "U" Pump is ruggedly and simply designed for long, dependable service and is furnished as a "packaged" unit, complete with motor, drive and pump mounted on a common base. Available with one to four feeds.

The new "U" Pump Catalog, UP-52, gives full information on the "U" type pump plus extensive application data including specific service recommendations for handling over 300 substances. Write for your copy, today. HILLS-McCANNA CO., 2355 W. Nelson St., Chicago 18, Ill.

HILLS-McCANNA

metering and proportioning pumps

Also Manufacturers of: Saunders Patent Diaphragm Valves Force Feed Lubricators • Magnesium Alloy Sand Castings

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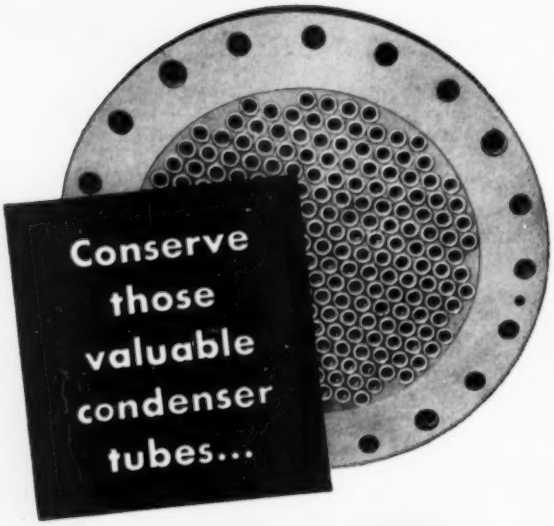


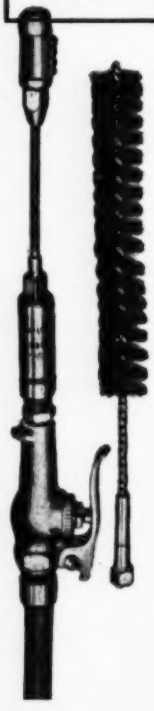
the Wilson Way

Usually a surface condenser tube fails in the first few inches of its length due to inlet end erosion. To protect against this costly deterioration, it is good practice to paint the tube sheets as well as the tube ends with a protective coating. This low-cost cleaning and application kit is designed to do the job quickly and efficiently. Only three simple steps are needed: (1) Clean all the tube ends. (2) Thin coating and squirt it into tube. (3) Attach the paint brush to the air motor and use it for fast, easy spreading.

This Wilson method insures complete removal of dirt, provides excellent paint adherence, makes certain paint is spread evenly on the tube. The work can be done in a hurry . . . with any labor available.

The Wilson Cleaning and Application Kit is but one of many Wilson accessories designed for the proper maintenance of condensers and heat exchangers. For packed condensers, there are packing tools, packing removal counterbores and ferrule wrenches. Wilson also makes a wide range line of tube cutters, tube expanders, flaring and belling tools, tube pullers, etc. TW 832

WILSON CLEANING AND APPLICATION KIT



Representatives in all principal cities
THOMAS C. WILSON, INC.
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Cable address: "Tubeclean," New York

WILSON
TUBE CLEANERS • TUBE EXPANDERS

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spot news

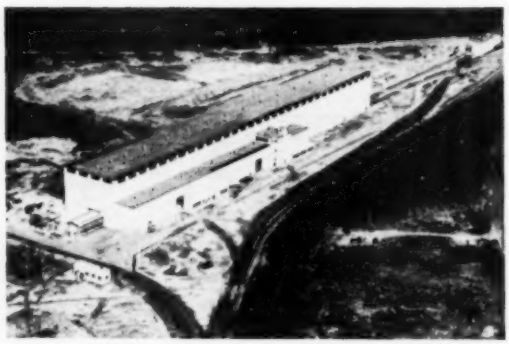
—Starts on page 88

forth automatically. Scrap from the tunnels is delivered to a bin from which it is conveyed to railroad cars just outside of the building.

When traveling in a direction away from the bin, the magnets are in the "off" position. When going toward the bin, they are "on" and pick up the metal as they move along. When they reach the bin, the power to the magnets cuts off and their loads are dropped.

The two carriers operate independently of each other and are equipped with 36 in. diameter magnets. They make a round trip in approximately three minutes.

The system has proven an efficient and low-cost method of ferrous scrap disposal.



Electric System Is Designed For Minimum Voltage Drop

An estimated daily demand load of 3500 kva will be required by the new manufacturing plant of Foster Wheeler Corp. at Mountaintop, Pa. The electric system was designed with particular attention to safety, future expansion, pressure drop, and to minimize the effect of simultaneous starting by big users.

Power is supplied by two high tension lines from Pennsylvania Power and Light Co., each line carrying 66,000 v. Two 2500 kva transformers step this voltage down to 4160 v before distributing the power to four power centers within the plant. Here the voltage is stepped down to 480 v and distributed to the individual machines through underground connections.

These power centers are placed so that there will be a minimum of voltage drop to any machine at all times. Welding equipment, for example, is fed from several of the power centers. Cranes and compressors—both being large, constant users—are fed from different power centers. The 2-million-volt X-ray machine which uses relatively little power is fed from one of the power centers to transformers in the X-ray building.

Lighting is fed from a power center having no heavy rotating equipment, to prevent the possibility of fluctuation of light intensity. It was designed to diffuse an intensity of 30 ft candles over the entire 89,500 sq ft of work area. To accomplish this, approximately 330 sealed beam lamps of 750 watts each are used.

Announcing Foster Wheeler's new

MOUNTAIN TOP PLANT...

completely tooled to effectively meet your most exacting needs for steam generators, heat-transfer and process equipment!

ANTICIPATING your requirements for more efficient central station, industrial and process components, Foster Wheeler has installed in this new plant, near Wilkes-Barre, Pa., the latest, most modern equipment, such as: the 8000-ton beam press, 2 million volt x-ray facilities, the newest developments in submerged arc-welding and high-speed drilling equipment, 83½ foot long stress-relieving furnace and others shown here.

This modern equipment, the plant's proximity to steel supplies, and its strategic location for direct rail shipment to all areas, assure you of fast, economical, high-quality fabrication to meet your specifications for the largest, heaviest drums and pressure vessels.

1. 8000-TON BEAM PRESS
Hydraulically operated, will bend steel plates 40' long, 8" thick.

2. PLATE EDGE PLANER
Will take the longest available plates, for cutting welding grooves.

3. OVERHEAD CRANES
Four large cranes capable of lifting the heaviest and largest equipment easily.

4. DOUBLE HOUSING PLANER
Highest speed planing.

5. AUTOMATIC WELDING MACHINES
Submerged-arc, automatic flux recovery-type, mounted on track.

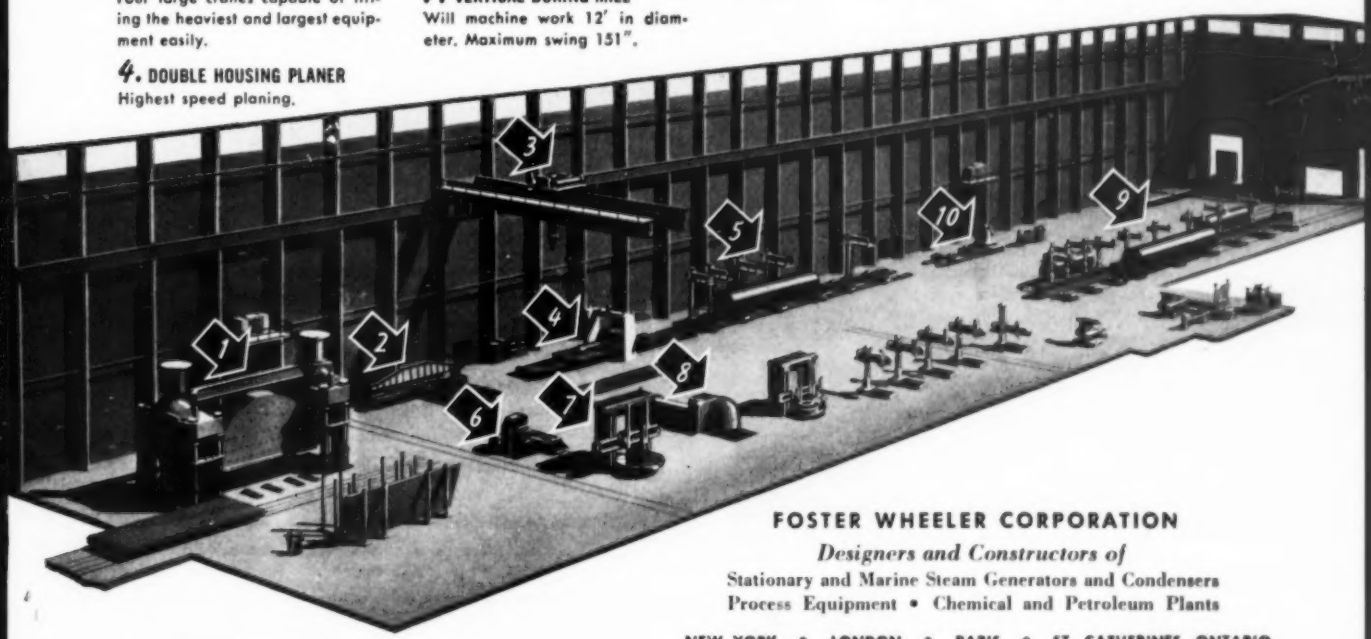
6. 500-TON CRIMPING PRESS
For cold-bending edge of plate preparatory to rolling.

7. VERTICAL BORING MILL
Will machine work 12' in diameter. Maximum swing 151".

8. BENDING ROLLS – PINCH TYPE
By hot or cold rolling will form cylinders for medium-pressure vessels.

9. HIGHEST SPEED DRILLS – RADIAL TYPE
These are mounted on ways and tracks, power positioned.

10. DRUM FACING MACHINE
Quick preparation of ends of cylinder for assembly with heads.



Artist's sketch of the main bay of the new Mountain Top, Pa. plant. 800' long, 90' wide, 75' high.

FOSTER WHEELER CORPORATION

Designers and Constructors of
Stationary and Marine Steam Generators and Condensers
Process Equipment • Chemical and Petroleum Plants

NEW YORK • LONDON • PARIS • ST. CATHERINES, ONTARIO

FOSTER WHEELER

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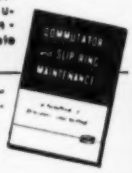
Keeps motors running like new... The easy, fast way to restore commutators and slip rings — WITHOUT DISMANTLING! — Substitutes low-cost prevention and correction for high-cost repair and rebuilding — COSTS LITTLE, SAVES A LOT.

RESURFACERS
Refinish commutators and rings to like-new condition even when ridged, scored or burned.

MICA UNDERCUTTERS
Stop sparking — help commutation — prolong brush life. For all sizes of commutators.

PRECISION GRINDERS
For more than surface smoothing—under machine's own power. Accurate to .001".

FLEXIBLE ABRASIVE
Cleans and burnishes commutators. Non-dusting. Complete size range.



FREE 39-page Handbook — Complete information on commutator maintenance. MAIL COUPON.

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meetings

. . . and exhibitions

Dec. 8-10	Joint Computer Conference and Show	Statler Hotel New York, N. Y.
Dec. 13-16	American Institute of Chemical Engineers (Annual Meeting)	Jefferson Hotel St. Louis, Mo.
Jan. 18-22	American Institute of Electrical Engineers (Winter General Meeting)	Statler Hotel New York, N. Y.
Jan. 25-27	American Society of Heating and Ventilating Engineers (60th Annual Meeting)	Rice Hotel Houston, Texas
Jan. 25-28	Plant Maintenance and Engineering Conference (Exposition)	Conrad Hilton Hotel Chicago, Ill.
Feb. 4	Instrument Society of America (9th Annual Regional Conference)	Statler Hotel New York, N. Y.
March 15-19	National Association of Corrosion Engineers (10th Annual Conferences)	Muehlebach Hotel Kansas City, Mo.
April 1-3	Electrical Maintenance Engineers Association of Southern California (Industry Show)	Shrine Hall Los Angeles

BASKET TYPE
STRAINERS

- **LARGE STRAINER AREA!**
- **EASILY CLEANED!**
- **LOW PRESSURE DROP!**

Davis Basket Type Strainers are used on pressure and suction pipe lines for the protection of meters, valves, pumps and other equipment. The No. 76 Strainer has a cylindrical basket with perforated sides and bottom supported at the top by a flange. When the cover is removed the basket may be lifted out easily for cleaning. Large body passage reduces pressure drop across the strainer to a minimum. The size of screen perforations depends on the fluid being strained and the foreign matter in suspension. Send for brand new strainer Bulletin No. 800 with complete details and specifications.

DAVIS
No. 76
STRAINER
SIZES
½" to 14"

Davis
DAVIS REGULATOR COMPANY

2509 SOUTH WASHTENAW **CHICAGO 8, ILLINOIS**

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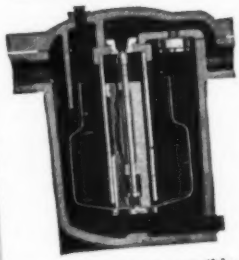
ILLINOIS Steam Trap



Simple—has only two moving parts

Valve Stem Travels Independent of Bucket—no other trap has this feature.

Instantaneous Valve Action — either wide open or tight shut — will not dribble on partial closing of valve under slow condensation rates.

Wire Drawing Impossible — valve has snap action.

Simple — moving parts are valve and bucket.

Cannot Air Bind — vents air continuously without loss of steam.

Cannot Blow Steam — always water sealed.

Surface Discharge—flushes out all grease and sludge.

Valve Seat — of special alloy, fully guaranteed.

Inspection Easy — without disturbing piping.

Works Equally Well on All Fluids — compressed air lines, air separators, air aftercoolers.

Write for Bulletin 35

Consult us on your requirements

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

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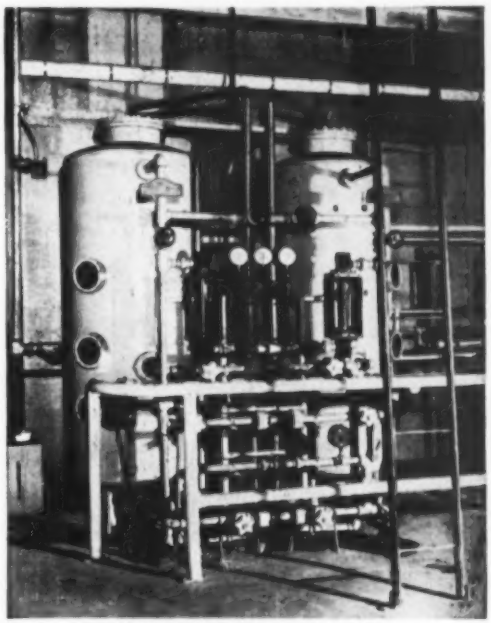

DUPLEX 3000 GPH H & T UN-A-BED DEMINERALIZING PLANT
producing highest quality silica free deionized water. Manual or Automatic. All sizes and capacities. Numerous installations.

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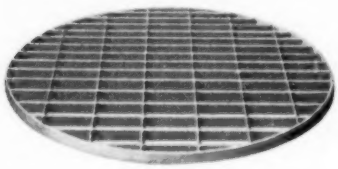
DAY SERVICE
HUNGERFORD & TERRY, INC.
CLAYTON 1, NEW JERSEY

REMOVE THE DANGER OF OPEN AREAS



Here's the Solution!

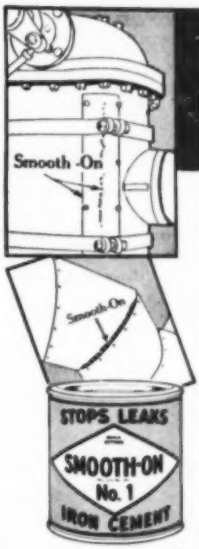
Blaw-Knox Electroforged Steel Grating is the ideal "coverage" for unprotected pits, light wells, basement stairways and other hazardous open areas. It is a one-piece steel "material" that provides safe footing under any conditions, and admits the maximum of light and air. *Strong . . . Silent . . . Secure.* Thousands of installations are still on the job after 20 years of traffic!

Send us dimensional sketch
We will then forward you price on grating cut to exact size. No nuts, no bolts, no special tools required. Don't delay . . . write today and make those danger spots both safe and usable!

BLAW-KNOX COMPANY
Grating Department
BLAW-KNOX EQUIPMENT DIVISION
2072 Farmers Bank Bldg.
Pittsburgh 22, Pa.
Sterling 1-2700

ELECTROFORGED® STEEL

BLAW-KNOX GRATING



Repairs both Cast and Sheet Metal

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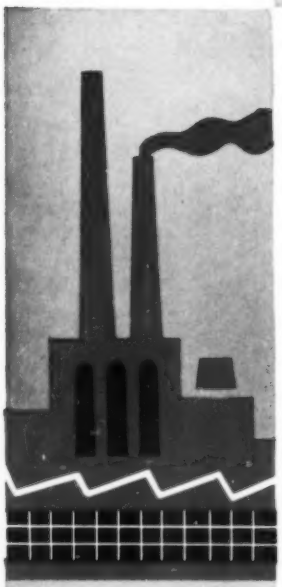

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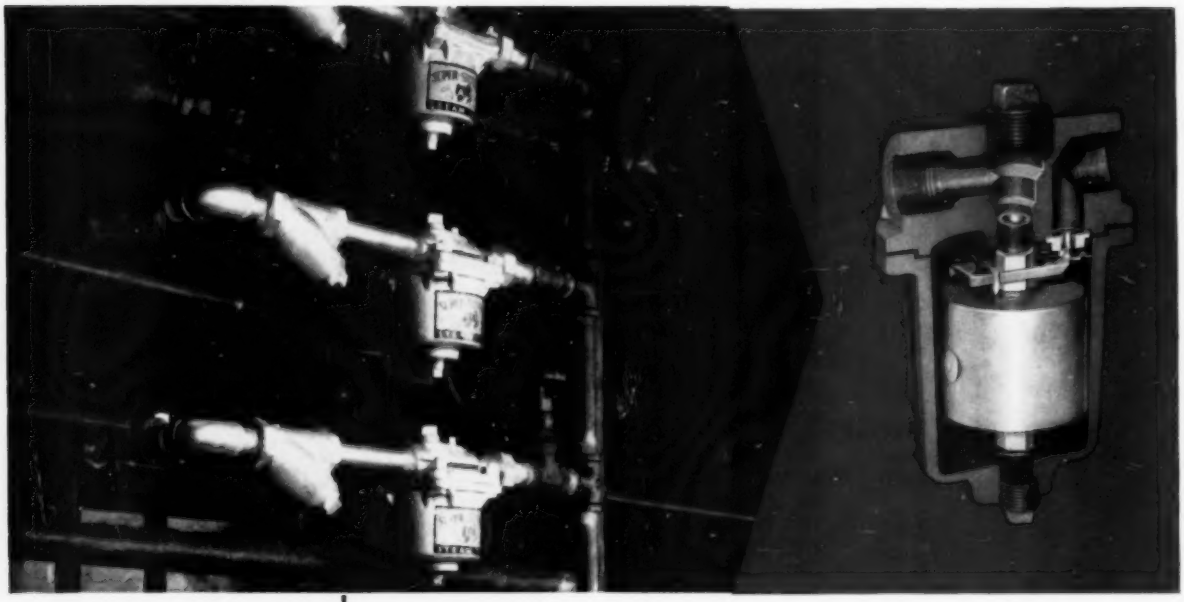

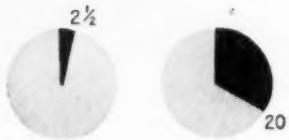

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